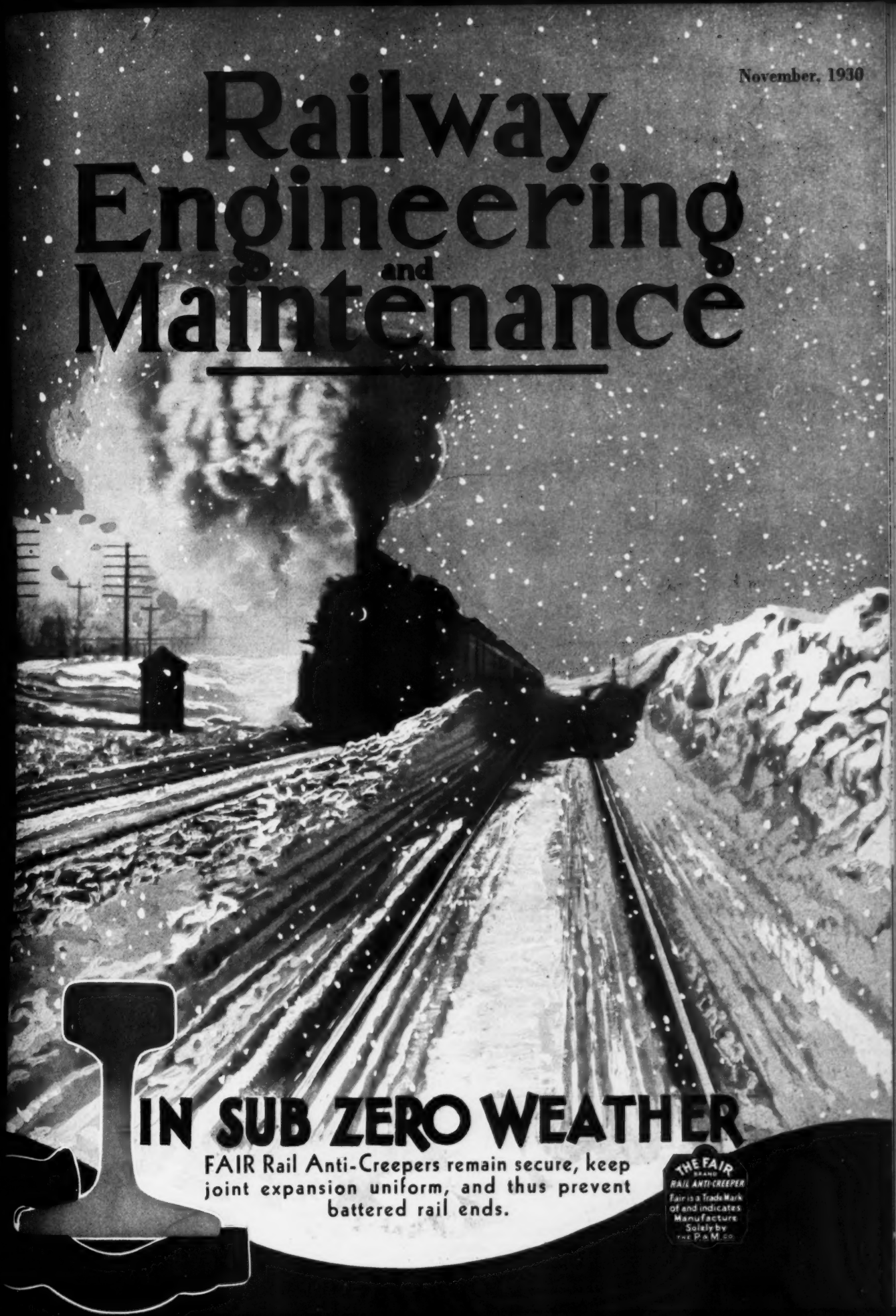
November, 1930

Railway Engineering and Maintenance


IN SUB ZERO WEATHER
FAIR Rail Anti-Creepers remain secure, keep joint expansion uniform, and thus prevent battered rail ends.
THE FAIR
BRAND
RAIL ANTI-CREEPER
Fair is a Trade Mark of and indicates Manufacture Solely by THE P & M CO.

Safe—for fast, heavy trains

proper tension on every bolt

TIGHT rail joints—tight bolts—good ballast—and a straight track ahead! What man at an engine's throttle asks more to run on time?

Main line tracks of Class 1 roads have long been the proving grounds for HY-CROME spring washers. Here their great reactive energy and wide reactive range have definitely proved their value. Here any claims we have made have been justified.

If you have not yet made the HY-CROME TRACK TEST, select any stretch of main line track where traffic is fastest and heaviest—and install HY-CROME. Fewer maintenance periods will convince you that the automatic compensation for wear provided by HY-CROME spring washers with their wide range of reaction is a cheaper and safer method of keeping track bolts tight than any other.

THE
RELIANCE MANUFACTURING CO.
MASSILLON, OHIO
Engineering Materials, Ltd., McGill Bldg.
Montreal, Quebec, Canada

HY-CROME
Reg. U. S. Pat. Office

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoffice at Chicago, Ill., under the Act of March 3, 1879.

Alphabetical Index to Advertisers, Page 58 Classified Index to Advertisers, 54-56

Using Treated Cross Ties *is not enough*

For Utmost Economy They Must Be *Plated Properly*

ALL the care and money spent for preservative treatment is lost if tie plates are used which cut into the treated layer of the timber.

You DO get proper protection from Lundie Tie Plates. Millions in service prove it. There are no sharp projections—instead the bottom has a series of rounded steps which hold track to gauge without cutting a single fibre of the tie.

Lundie Tie Plates guard against tie depreciation. Their use effects big economies, longer tie life and fewer renewals. They assure full return from treated cross ties.

The Lundie Engineering Corporation

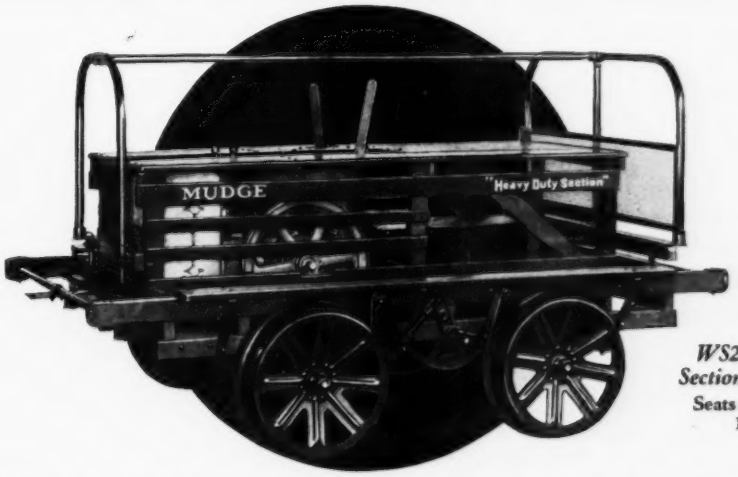
285 Madison Avenue, New York
59 East Van Buren Street, Chicago

LUNDIE TIE PLATE

RESPON

· THE · RAILROAD · WORLD ·

SIBILITY



WS2—Heavy Duty Section Car—8-12 h.p.
Seats 10 men—weighs 1040 pounds

MAN'S responsibility extends no further than the dependability of his equipment. A truth the Railroad World recognizes by providing only what has been found the best in actual service.

In Motor Cars this means Fairmont. For 20 years, that name has meant unfailing performance in all kinds of weather, for "the men along the line." And on the maintenance books in the office, that name has consistently stood for Lowest Over-All Cost, considering every factor from purchase price to depreciation. These are FACTS, based, not on isolated cases, but on the great majority! For over half the motor cars in use today are Fairmont products.

The finer the record, the greater is the responsibility to maintain it. Fairmont Motor Cars must deliver Lowest Over-All Cost or the makers are not satisfied.

FAIRMONT RAILWAY MOTORS, INC.

FAIRMONT, MINNESOTA, U. S. A.

General Sales Offices: 1356 Railway Exchange Bldg., CHICAGO

District Sales Offices: New York City Washington, D. C. St. Louis San Francisco New Orleans

FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada *Foreign Representative:* BALDWIN LOCOMOTIVE WORKS

Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, ballast discers, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances

Fairmont
Mudge
Performance on the Job Counts

·KNOWS·FAIRMONT·

Armor-Like . . .

RED LEAD fortifies against CORROSION

Prolongs the life of iron and steel

AIR and moisture . . . these are the foes of structural metal. In contact with iron or steel, they shorten its life. Kept away, the metal will last indefinitely.

Protection That Lasts

There's only one way to get the kind of protection that lasts for years. That way, authorities agree, is by using pure red lead.

Here's why. Red lead paint *seals up* metal with a tough, dense, protective coat. Air or moisture cannot reach it. Thus corrosion is practically eliminated. And longer life for the metal is assured.

High Quality Red Lead

For over a hundred years, pure red lead has been the standard paint for iron and steel. Pure, fine and highly oxidized, Dutch Boy Red Lead offers a measure of protection that no other pigment can give. Comes in two forms—paste and liquid. The liquid (ready for the brush) is supplied in six colors . . . the natural orange-red, two shades each of green and brown . . . and black. The paste comes in orange-red, and can be shaded to dark colors.

For information on any special painting problem, write our Department of Technical Paint Service, in care of our nearest branch.

DUTCH BOY
RED LEAD

NATIONAL LEAD COMPANY

New York, 111 Broadway; Buffalo, 116 Oak Street; Chicago, 900 West 18th Street; Cincinnati, 659 Freeman Avenue; Cleveland, 820 West Superior Avenue; St. Louis, 722 Chestnut Street; San Francisco, 2240 - 24th Street; Boston, National-Boston Lead Co., 800 Albany Street; Pittsburgh, National Lead & Oil Co. of Penna., 316 Fourth Avenue; Philadelphia, John T. Lewis & Bros. Co., Widener Building.

NORTHWEST

for handling your containers

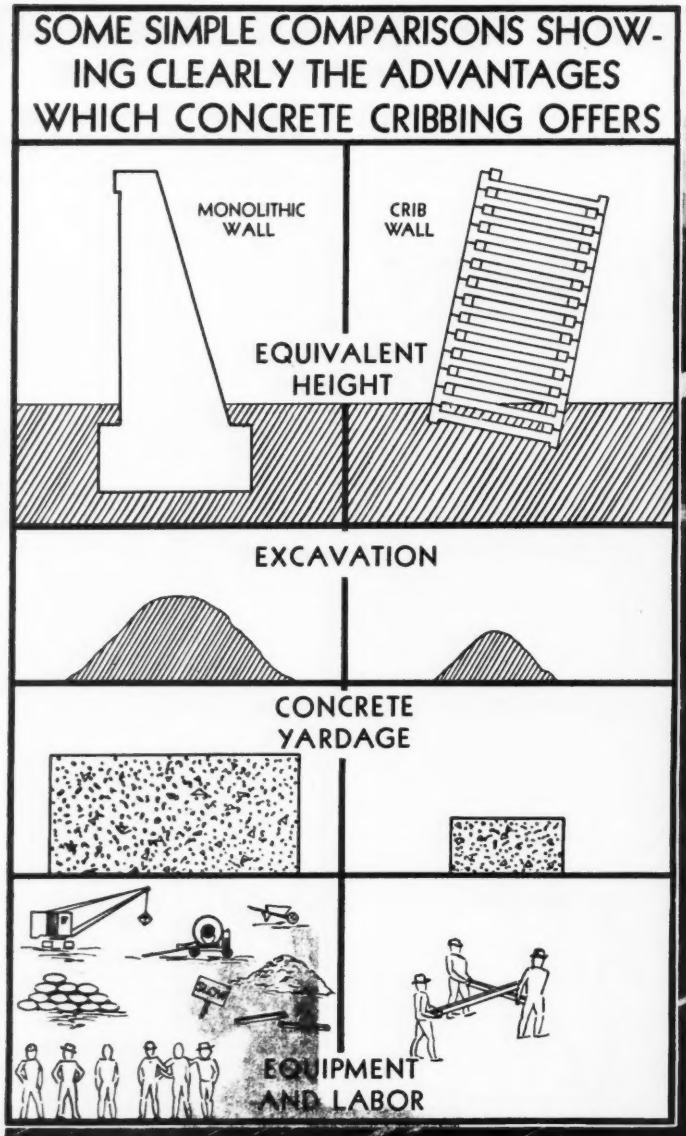
The L. C. L. container is coming! It's a real way to increase business and permits the use of cheaper cars for products that must be protected.

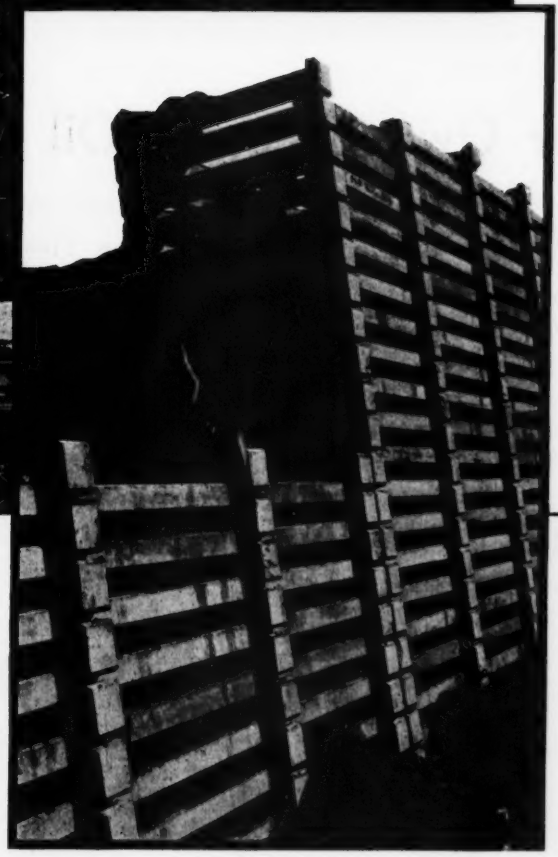
Handle these containers with a Northwest crane. It goes anywhere—travels over loading platforms or from gondola to gondola swinging the containers out to trucks or platform. No need to spot the cars under overheads or stiff legs!

Fourteen railroads are now using Northwests (one has 34) on all classes of work.

You will be interested in motion pictures of these machines showing their remarkable features. Let us show them to you. No obligation.

the crawler crane for flexibility


SOME SIMPLE COMPARISONS SHOWING CLEARLY THE ADVANTAGES WHICH CONCRETE CRIBBING OFFERS
MONOLITHIC WALL
CRIB WALL
EQUIVALENT HEIGHT
EXCAVATION
CONCRETE YARDAGE
EQUIPMENT AND LABOR



The large view shows two parallel walls of Massey Concrete Cribbing installed by the Delaware, Lackawanna & West. in Jersey City, N. J. The illustration at the right is a close-up of a Lackawanna wall being built in connection with the same improvement.

MASSEY CONCRETE CRIBBING

The reasons for adopting concrete cribbing in place of monolithic retaining walls are simple. Equal stability and permanence can be secured at less cost because less concrete is used, less excavation is required, less labor is needed, and no field equipment has to be provided. Interference to traffic during construction is practically eliminated and salvage in case of a change of location becomes possible.

The reasons for choosing Massey cribbing are equally simple. Its design is sound—only two members—no dowels—adequate interlocking—and sufficient flexibility to compensate for any uneven settling. Its construction is of the best. It is built in 12 modern plants backed by an organization that has pioneered in precast concrete construction for over 20 years.

The list of roads using Massey cribbing is imposing. The number is still growing. As the years of successful service pile up, more and more engineers are convinced of the permanent satisfaction as well as economy of this type of retaining wall.

If you do not have a copy of our catalog supplement on cribbing, ask for it.

MASSEY CONCRETE PRODUCTS CORPORATION

PEOPLES GAS BUILDING CHICAGO

Sales Offices:

New York Atlanta Cincinnati St. Louis Los Angeles
310 Dominion Sq. Bldg., 1010 St. Catherine St., West, Montreal, Que.

Manufacturers of precast concrete products — including culvert pipe, piling and houses » » »

RE&M11Gray

KREOLITE

We Distill Our Own Creosote Oil

By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired. We have treated hundreds of millions of feet of timber in the past 17 years without a single instance of decay.

By the installation of the latest and most modern framing and boring machinery, we assure the purchaser of timbers most accurately framed at lowest cost.

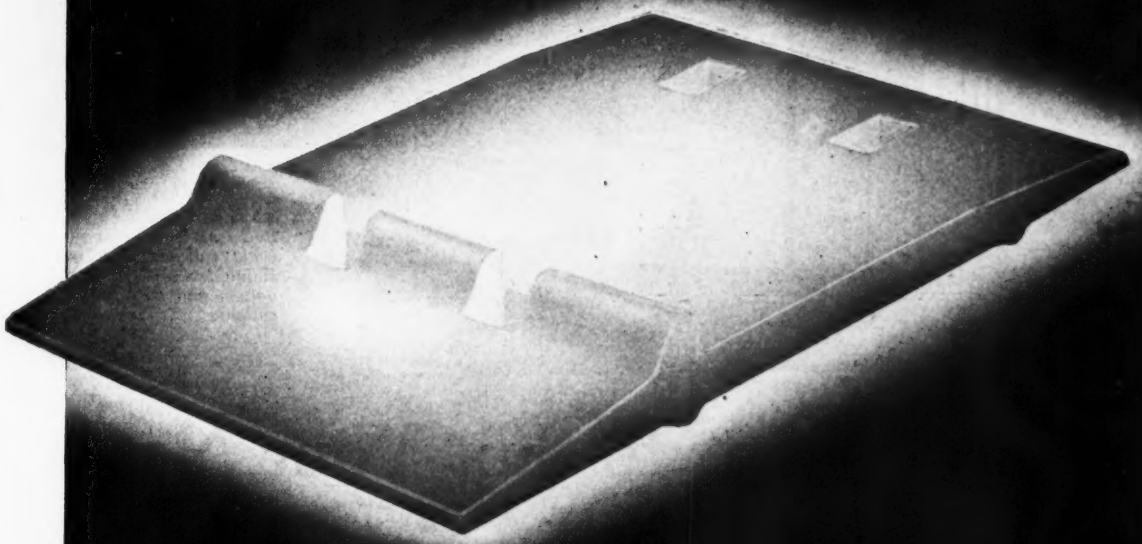
Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant at Granite City, Ill., (East St. Louis).

THE JENNISON-WRIGHT COMPANY, Toledo, Ohio

Branches in All Large Cities

R.R. TIES

TIE PLATES

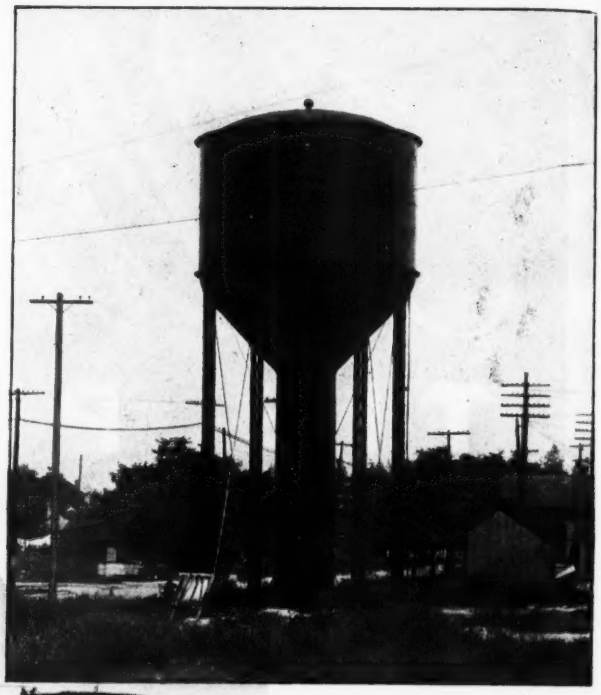


. . . . . Long and actual experience has given the Illinois Steel Company knowledge of track maintenance few manufacturing companies possess.

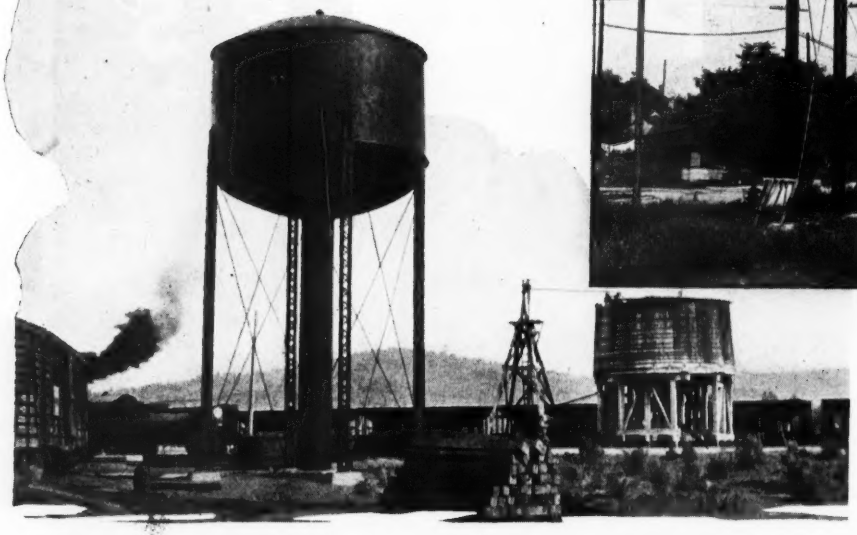
As a result, railroads find Illinois quality and service in track materials most satisfactory.

Illinois Tie Plates are made according to approved standards, hot worked and annealed to give them unusual toughness, and carefully inspected during the course of manufacture.

Central location of plants insures prompt delivery.



Below: 65,000-gal. ellipsoidal-bottom tank on the Southern Pacific at Madeline, Calif. It is 29 ft. to bottom.



Above: Conical-bottom steel tank on the Pennsylvania railroad at Terre Haute, Ind. It is 25 ft. to bottom and holds 50,000 gallons.

Built in Heights to Suit Your Needs

Whether you need a tank 3 feet to bottom, 51 feet, or any other height, any of our standard capacities can be built to meet those requirements. And regardless of the height, you get the same well-designed, well-proportioned looking structure.

The entire structure is built of steel. Replacements or repairs are few, as all parts of the tank are designed for long life. Maintenance costs are reduced to a minimum. A coat of paint applied every four or five years is all that is required.

Horton elevated tanks are easy to clean. They are built with large riser pipes, and wash-out valves. Sediment collects at the bottom of the riser, and is flushed out with a small amount of water by simply opening the valve.

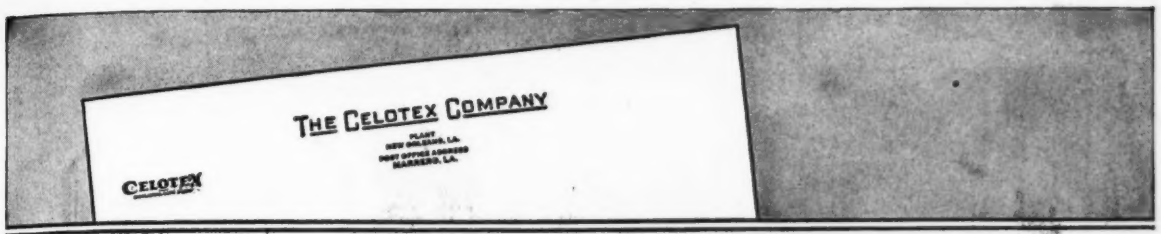
When contemplating additional water facilities on your road, ask our nearest office to give you estimating figures on tanks. State capacity, height to bottom and location.

CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Houston	1125 Electric Bldg.
New York	3156 Hudson Terminal Bldg.	Detroit	1519 Lafayette Bldg.
Cleveland	2202 Union Trust Bldg.	Philadelphia	1609 Jefferson Bldg.
Dallas	3309 Magnolia Bldg.	Atlanta	2136 Rhodes-Haverty Bldg.
Birmingham	1546 50th Street, N.	San Francisco	1007 Rialto Bldg.
Tulsa	2401 Exchange Bank Bldg.	Boston	1522 Consolidated Gas Bldg.

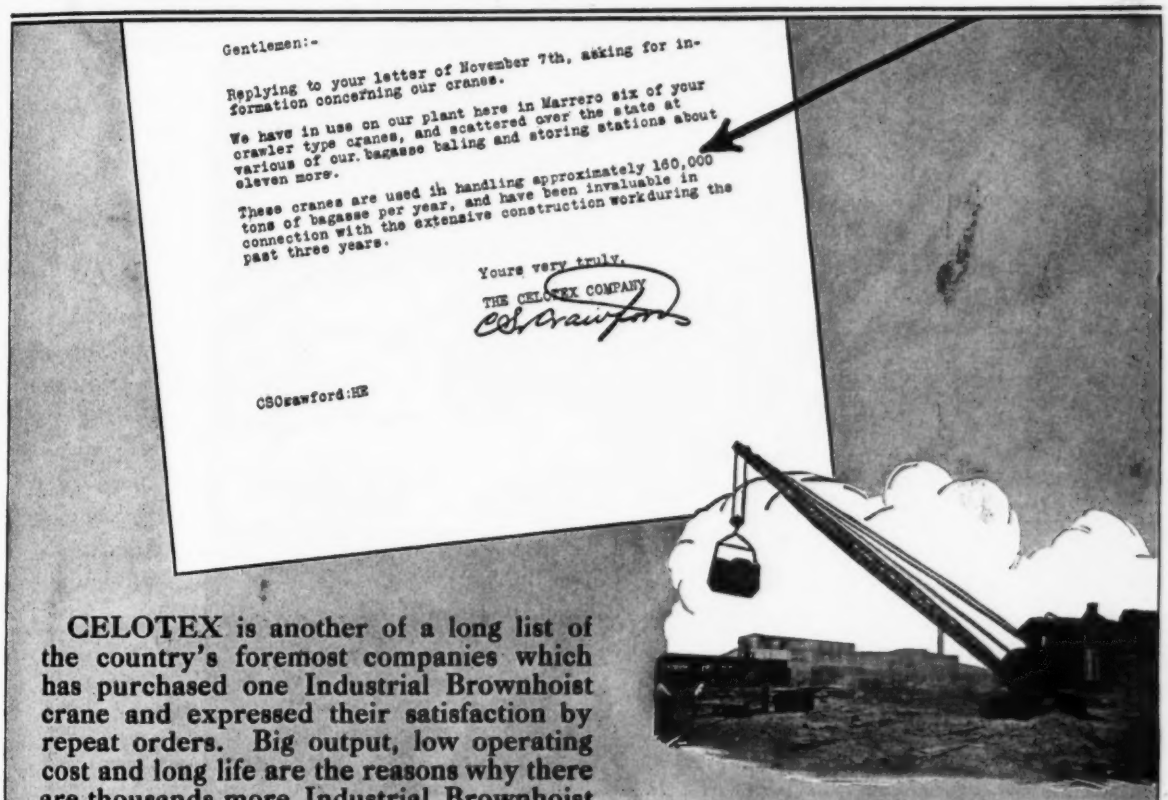
B-183

HORTON TANKS



"have been invaluable on construction work"

CELOTEX
BRAND
INSULATING CANE BOARD



Gentlemen:-

Replying to your letter of November 7th, asking for information concerning our cranes.

We have in use on our plant here in Marrero six of your crawler type cranes, and scattered over the state at various of our bagasse baling and storing stations about eleven more.

These cranes are used in handling approximately 160,000 tons of bagasse per year, and have been invaluable in connection with the extensive construction work during the past three years.

Yours very truly,
THE CELOTEX COMPANY
C S Crawford

CSCrawford:HE

CELOTEX is another of a long list of the country's foremost companies which has purchased one Industrial Brownhoist crane and expressed their satisfaction by repeat orders. Big output, low operating cost and long life are the reasons why there are thousands more Industrial Brownhoist cranes in service than any other make.

Wherever handling work is being carried on, Industrial Brownhoist locomotive and crawler cranes will be seen at work cutting costs. Crane sizes range from 6 to 200 tons capacity; shovels from ½ to 1¼ yards capacity. A choice of steam, gas, electric or Diesel power is available.

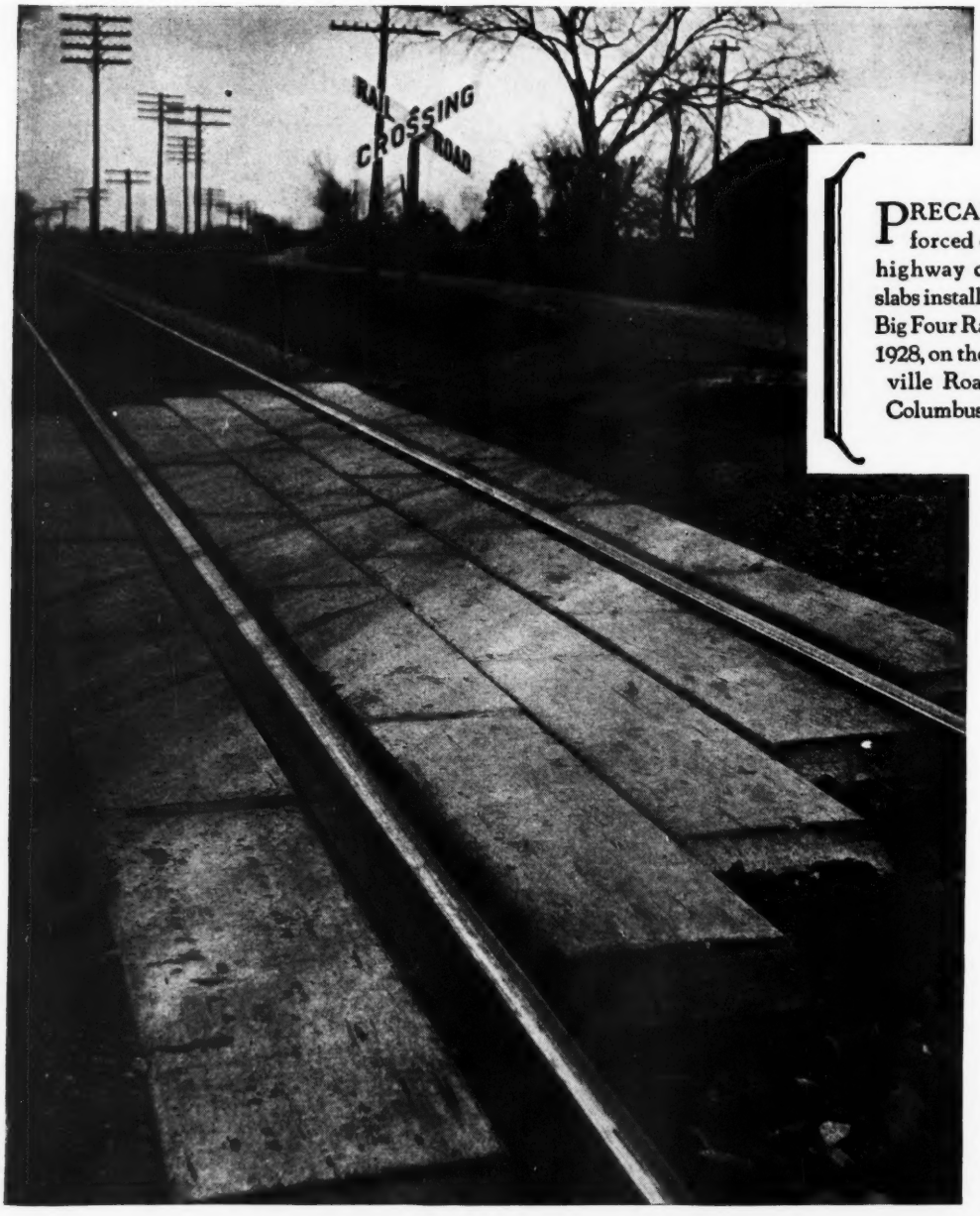
~~ *and they own 16*

The Celotex Company purchased their first Industrial Brownhoist crawler crane in 1922 and have since added fifteen more. These machines have already worked an average of over four and one-half years apiece.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco, Cleveland.
Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST



PRECAST reinforced concrete highway crossing slabs installed by the Big Four Railway in 1928, on the Georgeville Road, near Columbus, Ohio.

For Highway Crossings

CONCRETE slabs are easily removed with crowbars for track maintenance and replaced in service without damage or loss of materials. They provide a smooth-riding, durable roadway surface of moderate cost and low maintenance. Concrete slabs are the solution to the crossing pavement problem.

Your copy of "Recommended Design for Highway Crossings" will be sent on request

PORTLAND CEMENT *Association*

CONCRETE FOR PERMANENCE

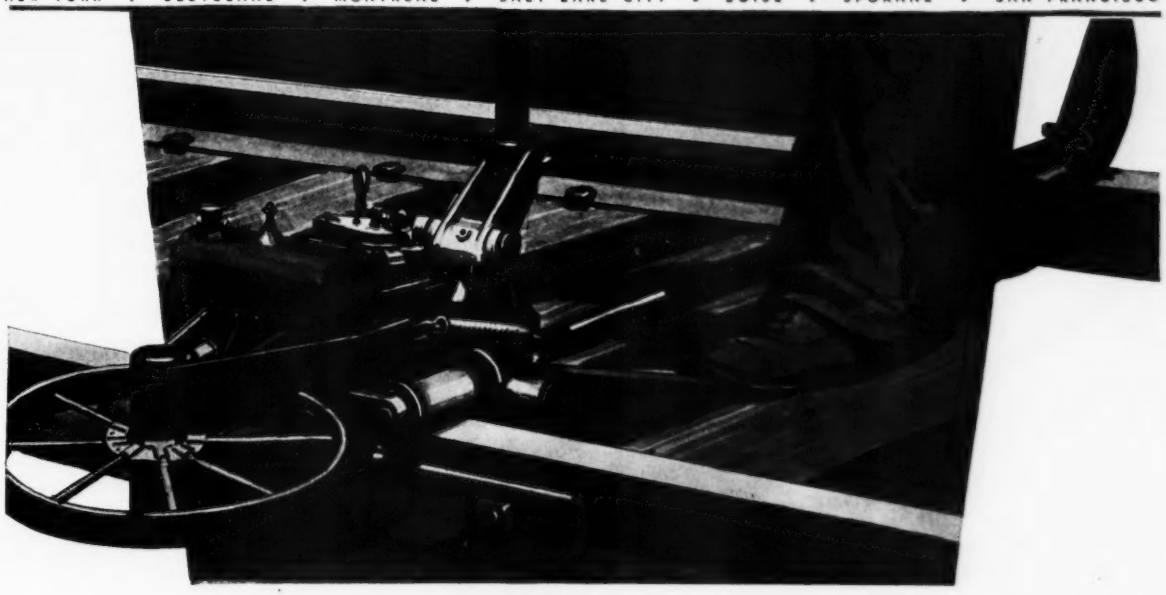
33 WEST GRAND AVENUE
CHICAGO

STOP RAIL CHIPPING

GOOD management dictates that costly new rail be protected. Teleweld's Slotting Tool for conditioning new steel prevents end-chipping by slotting and beveling rail ends after new rail has been cold rolled under traffic. ◆ At this critical time cold rolling has caused a flow of metal to the rail ends and chipping starts. The TELEWELD Slotting Tool should then be brought into service. It cuts away this excess metal and leaves a perfect slotted and beveled end that will not chip. ◆ The tool is fool-proof and simple in operation. One unskilled laborer can condition from one-half to one mile of track a day and do a perfect job at every joint. He simply clamps the tool to the rail, works the hand lever controlling the cutting device and rolls the tool to the next joint. ◆ Save yourself the grief of costly maintenance work later by leasing this tool now. Keep it on your line all year round . . pay for it only when in use. ◆ Send for complete details regarding this TELEWELD Slotting Tool and the attractive leasing plan today.

ELECTRIC RAILWELD SALES CORPORATION
RAILWAY EXCHANGE BUILDING, CHICAGO

NEW YORK ◆ CLEVELAND ◆ MONTREAL ◆ SALT LAKE CITY ◆ BOISE ◆ SPOKANE ◆ SAN FRANCISCO

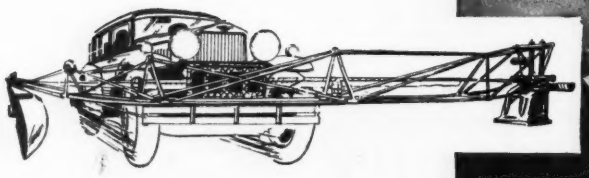


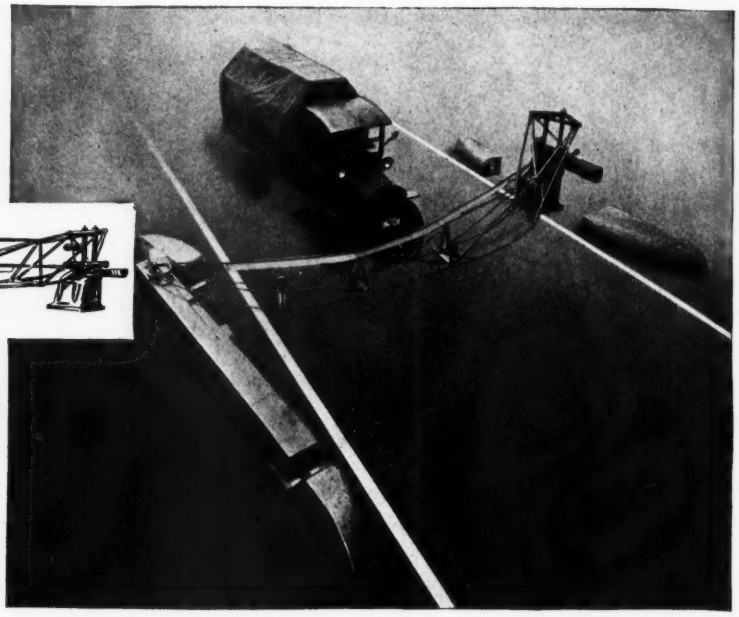
Rail End Restoration
Slotting New Rail

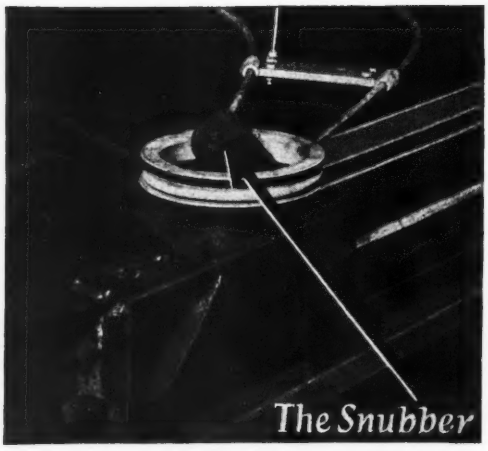
TELEWELD
A MILE AT A TIME

Frog and Switch Reclamation
Steel Bridge Reinforcement

LIKE a BRAKE of TREMENDOUS POWER!







ANY operator whose car or truck hits THE HIGHWAY GUARDIAN has a surprise coming to him. Instead of a costly wreck and possible fatal injuries the vehicle is brought to a stand-still by a powerful, yielding snubber.

With an action similar to a stop with four wheel brakes, control is taken out of the driver's hands. A cable of steel grips the front of the car and transmits the force of the impact to the hydraulically operated snubber. Within a few feet it stops the vehicle without damage to itself, the car or injury to occupants.

In every detail THE HIGHWAY GUARDIAN does a thorough job. Vehicles caught between lowered gates can push the barrier aside and drive to safety. A resistance of five pounds stops all downward motion, preventing damage to cars.

This positive barrier saves lives, protects property, prevents damage claims and creates good will. It gives the greatest protection at crossings per dollar invested.

FRANKLIN RAILWAY SUPPLY COMPANY, Inc.

NEW YORK CHICAGO SAN FRANCISCO ST. LOUIS MONTREAL

1880—One small factory; the first Bucyrus shovel.

50th anniversary!

of the oldest and largest makers of excavating equipment

In November, 1880—exactly 50 years ago—this organization had its beginning. In this half-century, *not a single week* has passed but some order has been shipped.

Today, Bucyrus-Erie stands supreme not only in mere size but in its advantages in serving you. Bucyrus-Erie and no other can give you . . . 50 years of field, shop and engineering experience . . . Three great specialized plants . . . A complete line containing exactly the machine to fit your work . . . Service stations throughout the United States . . . The experience gained by building over 11,000 machines.

Investigate what these advantages mean in terms of lower unit costs for your excavating.

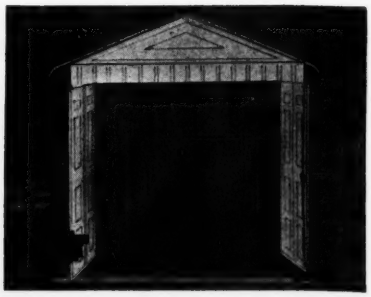
1930 — the world's most complete line — all sizes, types and powers. *Plants:* So. Milwaukee, Wis.; Erie, Pa.; Evansville, Ind. *General Offices:* South Milwaukee, Wis.

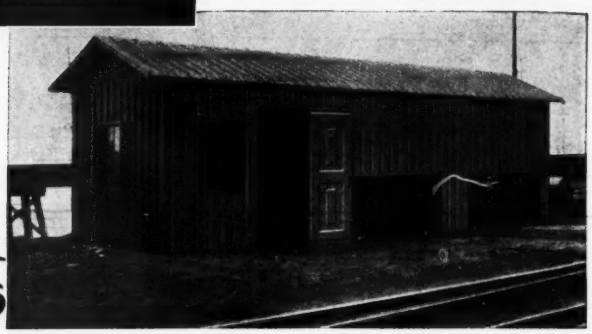
A-211—11-30—REM

BUCYRUS ERIE

Representatives throughout the U. S. A. Offices or distributors in all principal countries. *Branch Offices:* Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Dallas, San Francisco.

THE RAILWAY SHANTY IS PASSING





BUTLER READY-MADE STEEL BUILDINGS

Are Setting New Standards in Railway Structures

THE structures shown are popular types of shelters for motor track cars and tools. Scale houses, supply depots, dwellings, freight houses and car repair shops are some of the other railway activities which are logically finding shelter in Butler Ready-made Steel Buildings.

Fire safeness to offset lack of full fire protection along the right-of-way . . . complete materials, ready-made and readily transported . . . speed in erection by whatever labor crews are available or by Butler field crews . . . investment and maintenance lower than for any other comparable type of construction . . . structural features which insure permanence, yet which permit enlarging or taking down and re-erecting . . . these are some of the qualities which make Butler Ready-Made Steel Buildings so well adapted to railway needs. In them unique shaping multiplies the strength of steel. Throughout the maximum strength per pound is attained.

A new booklet pictures many types of installations. Send for it and call upon Butler engineers to supply full details.

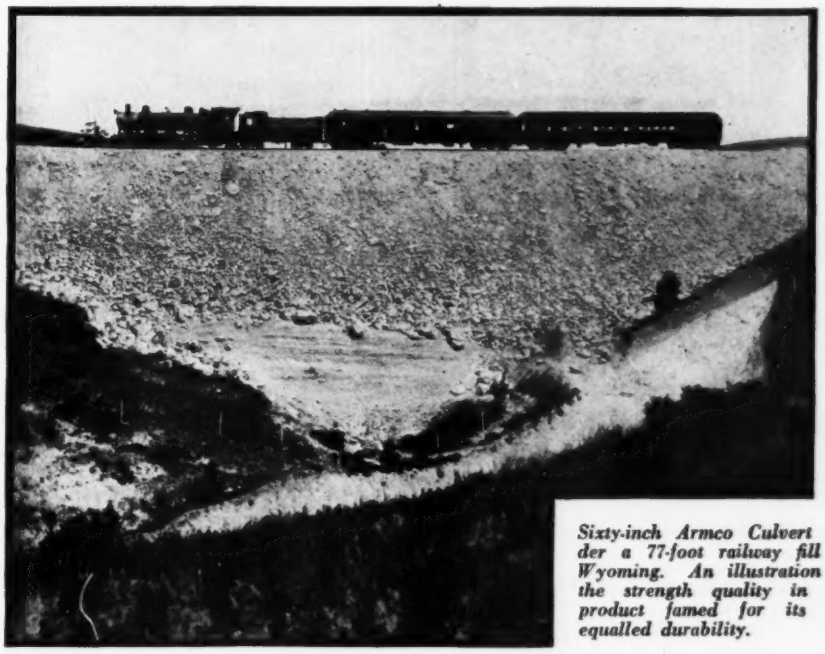
BUTLER MANUFACTURING COMPANY

1247 Eastern Avenue
Kansas City, Missouri

BUTLER

947 Sixth Ave., S. E.
Minneapolis, Minnesota

This great strength is common to *Durable* ARMCO CULVERTS



Sixty-inch Armco Culvert under a 77-foot railway fill in Wyoming. An illustration of the strength quality in the product famed for its unequalled durability.

SEVENTY-SEVEN feet beneath rolling tons of steel, with an additional ponderous weight of crowding stone and soil between . . . but this is no unusual task for Armco Corrugated Iron Culverts. Their exceptional strength prepares them to sustain loads which would crush the ordinary culvert.

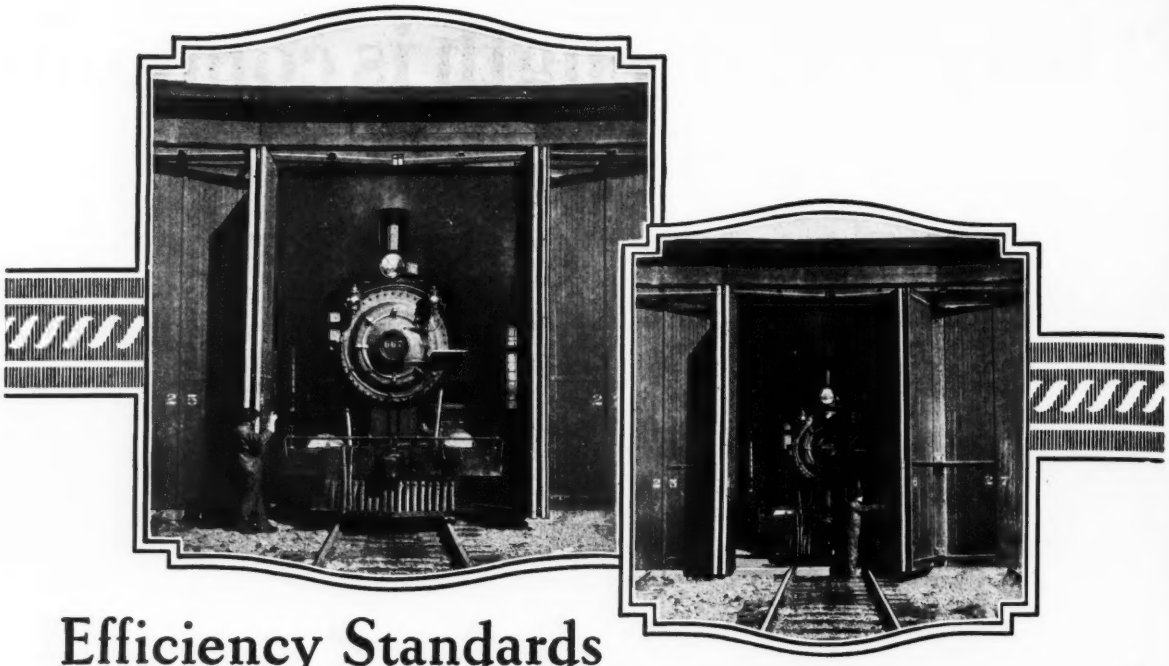
And, yet, strength alone has not won the conspicuous place of preference occupied by Armco Culverts. *Durability!* that's it . . . durability to an extent not found in the records of service of any other corrugated metal drainage product. *Lasting qualities!*

Armco Culverts, made of pure iron continuously since 1906, are the recognized champions of long life under the railroads and the highways of the nation. Because they last; because they serve year on year without attention, logically they cost less on a per-year basis. Railroads find this combination of strength and durability unbeatable. That's why more than 50,000,000 feet of Armco Culverts are in use. Send for new data affecting railroad maintenance.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand.

ARMCO CULVERT MANUFACTURERS ASSOCIATION
Middletown, Ohio

© 1930, A.C.M.A.



Efficiency Standards *demand* Industrial Slidetite !

The statement of the Rock Island Lines quoted below is typical of the experience of thousands of industries where R-W Doorway Equipment is giving constant service.

The Engineer of Buildings of the Rock Island Lines, Chicago, says:

"Doors on railroad buildings must stand severe weather conditions and unusually hard service. Yet they must operate smoothly, open completely to clear moving locomotives or cars, and not sag or stick. Minutes count in railroad operation; and a few minutes lost by a stuck roundhouse door are not easy to make up.

"When we recently doubled the capacity of our Burr Oak roundhouse, Richards-Wilcox hangers and ball bearing trolleys were installed on the 20 new door openings. This roundhouse has 40 stalls for freight and suburban passenger locomotives; and as the locomotives are constantly coming and going the 13x17 ft., 4-fold doors are opened and closed many times during the 24-hour day. Although the doors weigh about 1700 lbs. apiece, they are easily operated by one man.

"R-W equipment was specified for this roundhouse because of the performance of R-W equipment in roundhouses, storehouses, and shops throughout the Rock Island system. The first R-W ***Slidetite*** equipment was installed on the doors of our Chicago coach shops in 1919, and it and some 200 other sets are still in daily use.

"Eight years' experience has proved that R-W equipped doors operate smoothly and easily, stay where they are put, do not sag or stick, and seldom get out of order. The ordinary double door has too much weight on the hinges and no support from above, so that it quickly sags and warps.

"The first R-W equipment installed by us is still in use, and repairs and maintenance have been very light."

There's not an industrial doorway problem, large or small, that R-W Doorway Equipment will not solve. R-W Doorway Engineers will help solve your problems.

Write the nearest service branch

"Quality leaves its imprint"

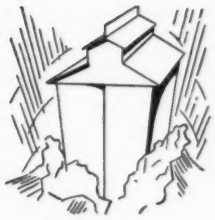
Richards-Wilcox Mfg. Co.

"A HANGER FOR ANY DOOR THAT SLIDES"

AURORA, ILLINOIS, U.S.A.

Branches: New York Chicago Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Des Moines Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit Atlanta Richards-Wilcox Canadian Co., Ltd., London, Ont. Montreal Winnipeg

50 years 1880 1930



GIFFORD-WOOD IS COMING THROUGH —EVERYWHERE

From Denver to Boston—for hard coal and soft coal—for large plants and small plants—for old reliable concerns and for the newcomers—Gifford-Wood is leading the field in the construction of coal plants.

This is a Gifford-Wood year.

All the good work—in research, engineering and construction methods during the past decade is bearing fruit. The full automatic trolley bucket idea, introduced by Gifford-Wood, is now becoming an accepted standard. Actual results in low handling costs and low maintenance of Gifford-Wood plants is proving the wisdom of Gifford-Wood policies.

We invite you to visit the new Gifford-Wood plants—some are now being built—the rest completed during the last few weeks.

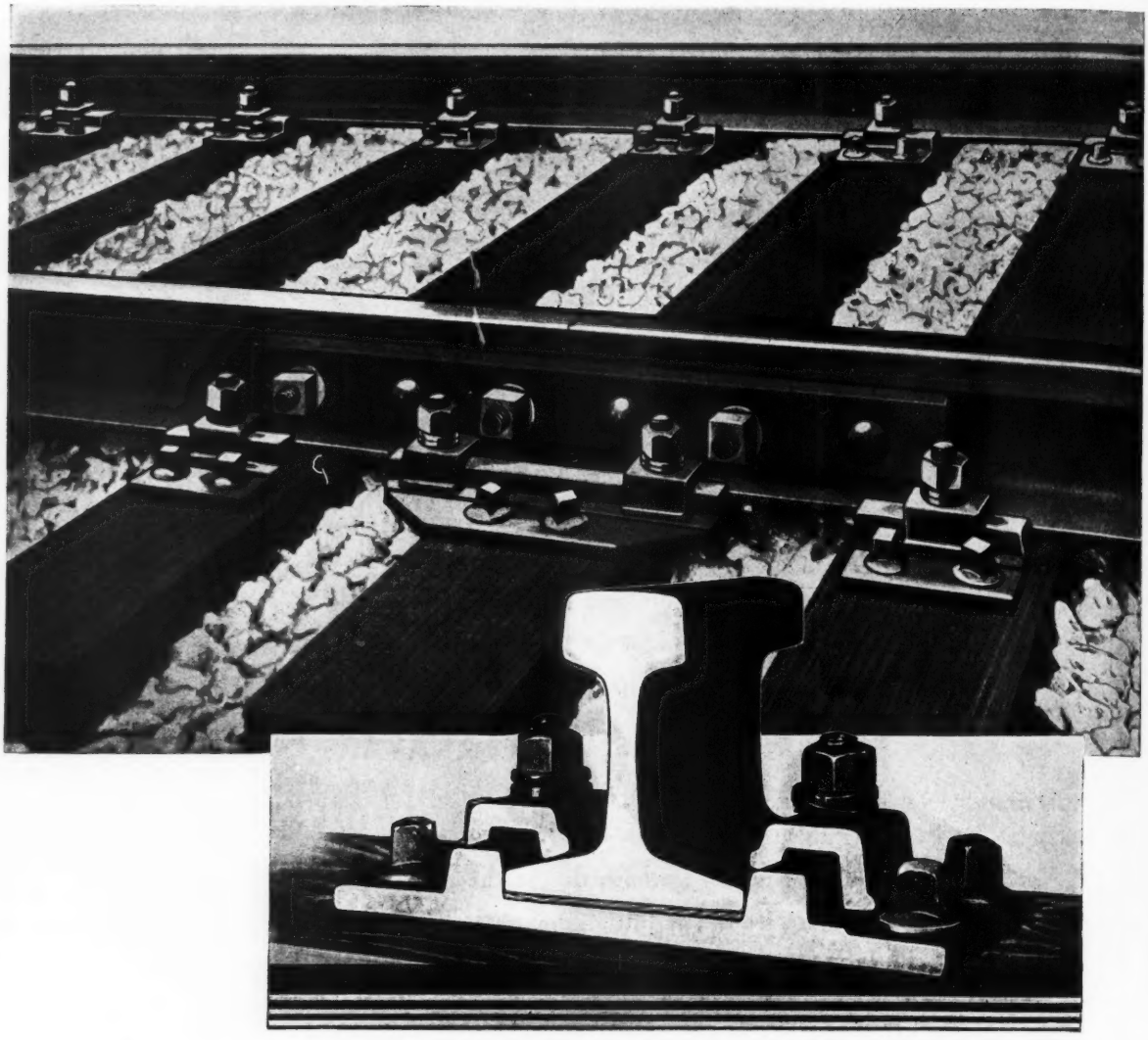
Gifford-Wood customers are our best asset. Get the facts from them.

Recent Installations

P. A. Gillespie, Troy, N. Y.
Northville Land & Lumber Co., Northville, N. Y.
W. J. Martin Coal Co., Freeport, L. I.
Adam F. Meyer Coal Co., Cincinnati, Ohio
Farmers Mill & Elevator Co., Columbia City, Ind.
Catsman Coal Co., Flint, Mich.
Malcomson Coal Co., Detroit, Mich.
Atlantic Coal Co., Providence., R. I.
New England Fuel & Transportation Co., Quincy, Mass.
Windsor Ice & Coal Co., Windsor, Ontario
Burkhardt Consolidated Co., Akron, Ohio
Inland Valley Coal Corp., St. Louis, Mo.
Curran Coal Co., St. Louis, Mo.
Valley Coal Co., Wethersfield, Conn.
C. B. & F. H. Goss, Inc., Melrose, Mass.
F. E. Powers Co., Worcester, Mass.
Newell Coal & Lumber Co., Pawtucket, R. I.
D. L. Miller, Inc., Hillside, N. J.

GIFFORD-WOOD CO.
COAL AND ICE HANDLING EQUIPMENT
Main Office and Works: Hudson, N. Y.
Chicago: 565 W. Washington St. New York: Graybar Building, Lexington Ave. at 43rd St.

4762



Now - a modern track for modern traffic

TRACK construction has not kept pace with the rapid development in other phases of transportation. Now—to meet the demands of modern heavy duty, high speed transportation, Carnegie Steel Company is prepared to furnish GEO—a new type of track construction distinctly in advance of present day methods.

Many advantages recommend the use of GEO. Mechanical wear between tie and plate is practically eliminated. The life of both rail and tie is increased, and rails may be renewed without disturbing tie plates or ties on well compressed ballast, thus materially reducing maintenance expense. Rails may also be laid close at joints, making quieter and smoother riding track.

More than 6000 miles of GEO track in foreign countries has effectually demonstrated its superiority. Carnegie Steel Company is the sole manufacturer and distributor of GEO track materials in America. Descriptive literature will be sent at your request, and Carnegie engineers are always at your service.

CARNEGIE STEEL COMPANY - PITTSBURGH, PA.

Subsidiary of United States Steel Corporation

98

GEO TRACK CONSTRUCTION

When water runs wild, the road-bed suffers

●

Ample culvert and drainage capacity is road-bed insurance

SUB-SURFACE water is a great road-bed disturber. It causes misalignment and uneven track. Wherever it is allowed to collect in open cuts, tunnels, sags, multiple track or track pans, a job is brewing for the maintenance gang.

Remove sub-surface water as quickly as you can and as economically as possible.

For drains of unusual efficiency and long life, the choice of many railroads is Toncan Iron.

Toncan Iron drains have an added resistance to corrosion and erosion gained through the protective presence of copper and molybdenum. These elements give the naturally resistant iron still further protection against weathering and corrosion.

Adequate drainage is a first step towards reduced maintenance costs. Consider where drains and culverts can be used to advantage. Making liberal use of them is good economy.

TONCAN CULVERT MANUFACTURERS' ASSOCIATION
MASSILLON, OHIO

Plants located in all Parts of United States and Canada

"RESCO" Cast Steel Guard Rail Clamps

will not stretch, bend or break!

Other Reading Specialties:

ACCO Drop-Forged Guard Rail Clamps;
ACCO One-Piece Guard Rails;
Samson Rail Benders;
Reversible Rail Benders;
ACCO "Triple A" Rail Benders;
Compromise Joints

"Resco" Guard Rail Clamps are high-grade electric cast steel, properly heat-treated. The I-beam section is amply strengthened to prevent stretching or breaking under most severe stresses. Furthermore, "Resco" Guard Rail Clamps can be applied without disturbing the guard rail.

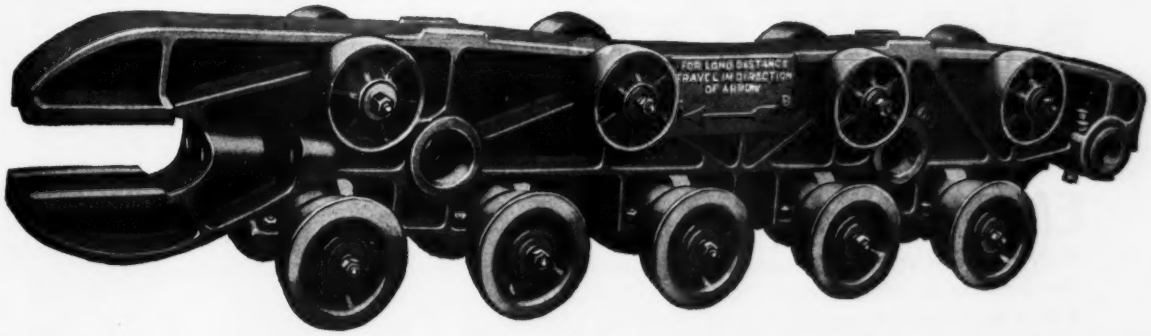
READING SPECIALTIES

AMERICAN CHAIN COMPANY, *Inc.*, BRIDGEPORT, CONN.

World's Largest Manufacturers of Welded and Weldless Chains for All Purposes

In Canada: **Dominion Chain Company, *Limited*, Niagara Falls, Ontario**

Brake chains; Train chains; Sling chains; Switch chains; Gate chains; Wrecking chains; Crane chains; End Door chains; Door Operating chains; Brake Beam chains; Brake Beam Safety chains; etc.



The
TRACTION FRAMES
ARE SINGLE-PIECE
STEEL CASTINGS

In line with the P & H principle of unit-cast steel construction, the traction frames of P & H Corduroy crawlers are single-piece steel castings. The whole simple crawler mechanism is held in permanent alignment by them. There can be no weaving . . . no excessive wear and breakage. Bearings and gears last longer.

Notice that the frame shown above is bored to receive the car body axles, which in turn are machined to fit. Thus there can be no play at these important points. For play here would soon seriously affect the operation of the entire machine.

These unit-cast steel Corduroy frames, together with the other unit-cast main frames, comprise one of the outstanding reasons for the great strength, long life and low maintenance of P & H Excavators. Write for special, illustrated bulletins which describe this and other features of P & H construction in detail.

HARNISCHFEGER CORPORATION
Established 1884
4420 W. National Ave., Milwaukee, Wis.
Offices and Agents in Principal Cities
Warehouses and Service Stations
Hoboken, Memphis, Jacksonville, San Francisco, Los Angeles, Seattle, Dallas

P&H

SHOVELS CRANES DRAGLINES

Now.. Better Right-of-Way Protection

with

NATIONAL

DIRT SET ANCHOR END and CORNER POSTS

Here is one of the most important improvements ever offered in the science of fence construction for right-of-way protection. Fence posts which combine, in the highest degree, these three vital points of excellence—

STRONGER... *Save Time and work*

They afford the maximum rigidity and resistance against time, weather and every kind of strain. Added to their efficiency in wear is the economy of construction. They are simple and easy to install.

Here is method of setting. Bore a 9-inch hole—drop in post—turn post around using brace as a lever. Anchor plates are thus anchored in solid ground at bottom of post hole. You are now ready to stretch your fence. No delay; just a quick, easy and satisfactory job. And when done it is done "for keeps."

From every point of view of long-time protection and economy, first and last, your maintenance department will find it best to specify the Fencing that is internationally known and used.

AMERICAN FENCE

For there is no question of the need for protection of the life and property bordering the right-of-way. To neglect it is to take dangerous chances. Don't wait for a heavy damage suit which would cost more than the efficient safeguard of a good fence.

American Railroad Fence, National End and Corner Posts and Banner Steel Line Posts meet every specification recommended by the American Railway Engineering Association.

EXPANDING ANCHOR

Size when folded 5" by 7⅛"— diagonally 9½".

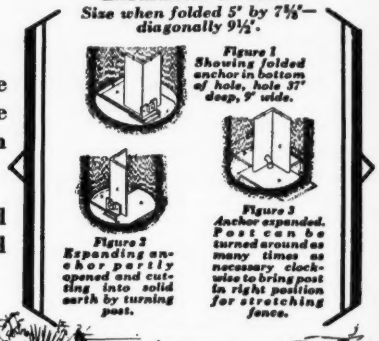


Figure 1 Showing folded anchor in bottom of hole, hole 37" deep, 9" wide.

Figure 2 Expanding anchor partly opened and cutting into solid earth by turning post.

Figure 3 Anchor expanded. Post can be turned around as many times as necessary clockwise to bring post in right position for stretching fence.

AMERICAN STEEL & WIRE COMPANY

SUBSIDIARY UNITED STATES STEEL CORPORATION

208 S. La Salle Street, Chicago

Other Sales Offices: Atlanta Baltimore Birmingham Denver Detroit Kansas City Memphis Milwaukee Pittsburgh Salt Lake City St. Louis

Pacific Coast Distributors; Columbia Steel Company, San Francisco Los Angeles Portland Seattle Honolulu

30 Church Street, New York

Boston Buffalo Cincinnati Cleveland Dallas Minneapolis-St. Paul Oklahoma City Philadelphia Wilkes-Barre Worcester

Export Distributors: United States Steel Products Co., 30 Church St., New York City

SAFETY

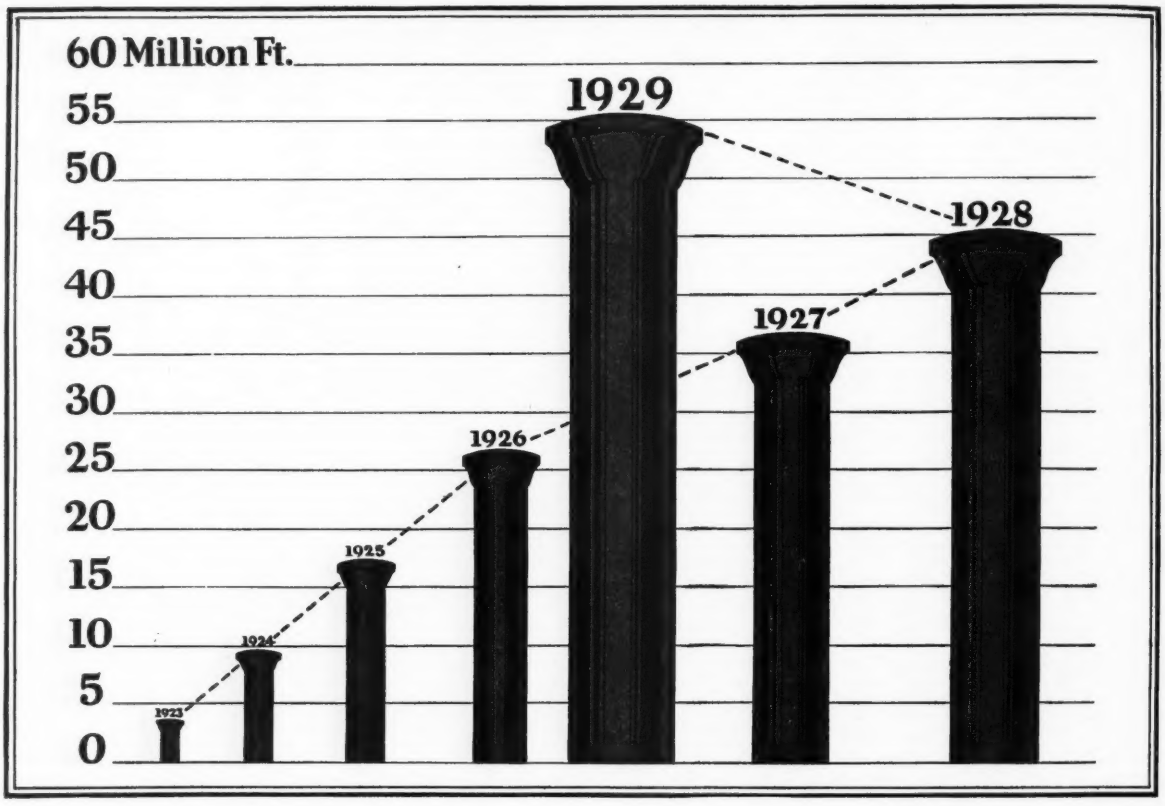
HEAVY RAILS AND FAST TRAINS

CALL FOR SAFE JOINTS

IN its field, there is no device today contributing so much towards safety and economy as the Headfree Rail Joint.

THE RAIL JOINT COMPANY
165 Broadway—New York

KEEPING PACE WITH PROGRESS



. . . *today*, more than 10,227 miles of U.S. deLavaud Pipe are in service

In December 1929, more than 54 million feet, or 10,227 miles of deLavaud Pipe — manufactured by the U. S. Pipe and Foundry Company — were in service throughout the country. A mighty fine record of acceptance for this sturdy seven-year-old product!

The first year of its manufacture in the United States, more than three million feet of deLavaud Pipe were put down. Since that time, its popularity has increased by leaps and bounds. The above chart tells the story.

Strength, flexibility and greater carrying capacity are the outstanding reasons for deLavaud Pipe's wide acceptance. DeLavaud Pipe is produced by pouring molten iron into a rapidly revolving metal mold. Centrifugal force holds the metal against the sides of the mold and drives out impurities with a force many times greater than gravity. The metal mold is encased in a water jacket, the cooling action of which brings about the remarkably fine granular structure of the iron.

Immediately after coming from the machine, every length of deLavaud Pipe is uniformly annealed in a specially constructed furnace where controlled heat eliminates all possibility of casting strains.

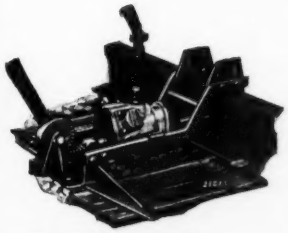
DeLavaud Pipe is manufactured in thicknesses and weights in strict accordance with the specifications of the American Water Works Association and the American Gas Association as well as the United States Government Specifications. The new deLavaud Handbook gives complete information. Write for your free copy today.

United States Pipe and Foundry Co., Burlington, N.J.

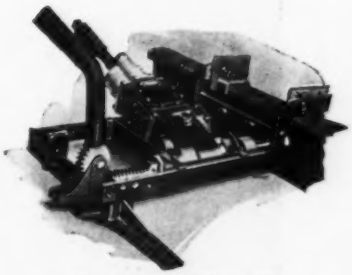
Sales Offices: New York, Philadelphia, Pittsburgh, Cleveland, Buffalo, Chicago, Dallas, Birmingham, Kansas City, Minneapolis, Seattle, San Francisco, Los Angeles

Our pipe bears the "Q-Check" trademark of The Cast Iron Pipe Research Association

Size 99C Track Wrench—bolts up track 10 times faster than hand methods.



Size D Bonding Drill—drills a 9/16″ bond hole in 15 seconds.

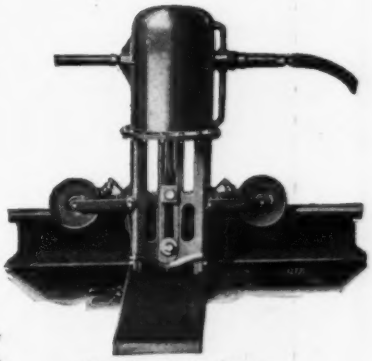


Size 90 Rail Drill—drills a 7/8″ hole through web in 30 seconds.

I-R Track Tools and Compressors help reduce rail laying costs

The tools shown here indicate several operations on which economies are possible by the use of I-R pneumatic equipment. Each of these tools is a proven labor- and time-saver on its particular class of work.

Size CC250 Spike Driver—drives a straight spike in 5 to 6 seconds.



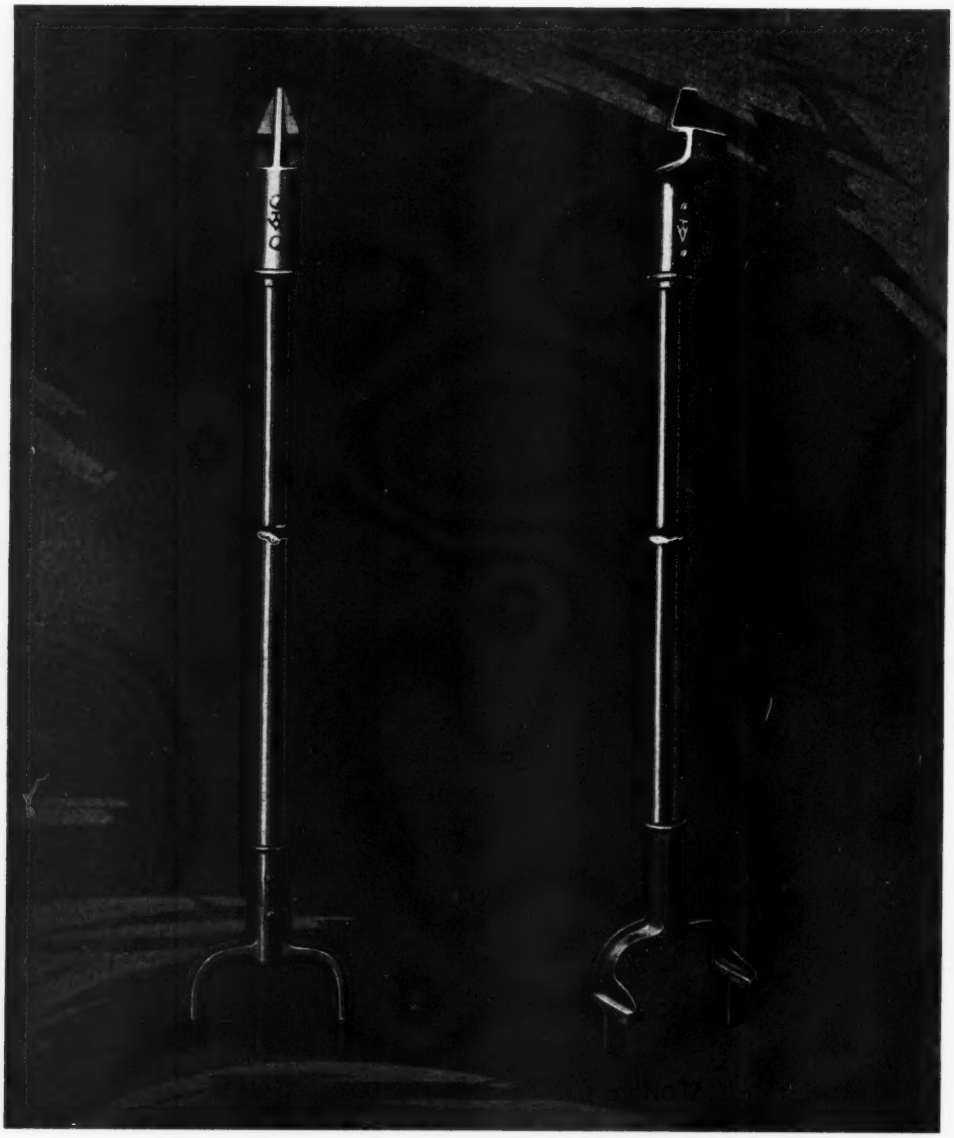
Size SP9 Spike Puller—pulls spikes at the rate of 8 to 10 a minute.

INGERSOLL-RAND COMPANY
11 Broadway New York City
Branches and distributors in principal cities the world over.
For Canada Refer—Canadian Ingersoll-Rand Co., Limited.
10 Phillips Square, Montreal, Quebec
283-TT

NEW AREA STANDARD TRACK GAUGE

Start Using It on Your Fall Work

ALWAYS IN STOCK **IMMEDIATE SHIPMENT**

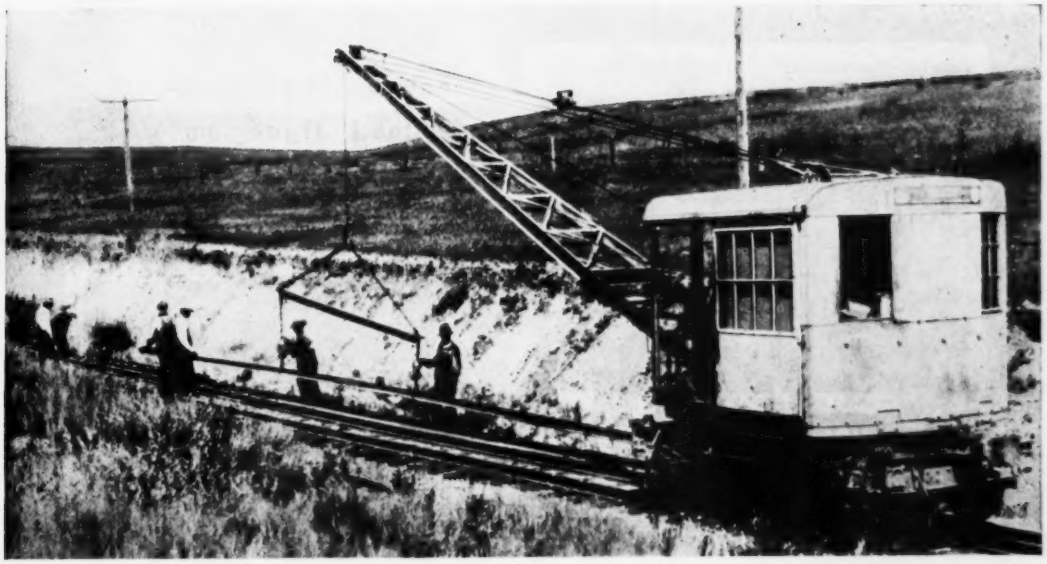


VERONA TRACK GAUGE NO. 17
Insulated

Latest approved A. R. E. A. design. Sturdy — durable — extra heavy pipe — wearing parts cast steel recessed to gauge over burred rails — weight only 17 lbs.

VERONA TOOL WORKS
PITTSBURGH, PA.

20 miles an hour is good *Crane time*



Model 20 Burro Crane used on single track line—can be run to a siding to clear for trains

Fast Travel Speeds Mean— More Operating Hours

Burro travel speeds, ranging from 1½ to 20 miles per hour, make possible more hours of real crane operation by cutting to a minimum the amount of time lost in traveling from job to job.

Increased Crane Uses

The Burro's uses are greatly increased because of its ability to quickly travel from one job to another under its own power. Out on the line and under traffic the Burro can quickly be run to sidings to clear for trains.

Less Work Train Time

The Burro can very frequently be used for hauling men and material to and from work.

Axle journals mounted on springs insure perfect safety when traveling at maximum speed.

Burro REGISTERED U.S. PATENT OFFICE **Cranes**

Write for Bulletin F-50

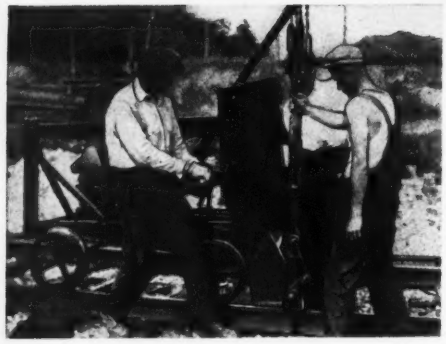
CULLEN-FRIESTEDT COMPANY 1300 So. Kilbourn Ave. CHICAGO, ILL.

"Later On" Is Here NOW

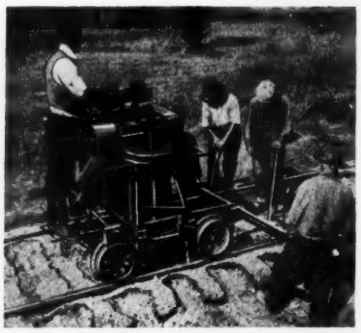
NORDBERG POWER ADZER

1930 saw much maintenance work deferred to be taken care of "later on".

"Later on" is here now, so far as *planning* the 1931 program is concerned.



NORDBERG SPIKE PULLER



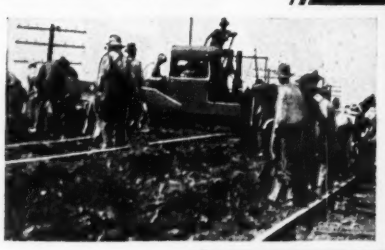
NORDBERG POWER JACK

You will find Nordberg Machines a potent factor in handling next year's track work under these conditions—not only enabling you to catch up with deferred work, but *to surpass former track standards.* Both of these can be attained at a big saving over hand methods.

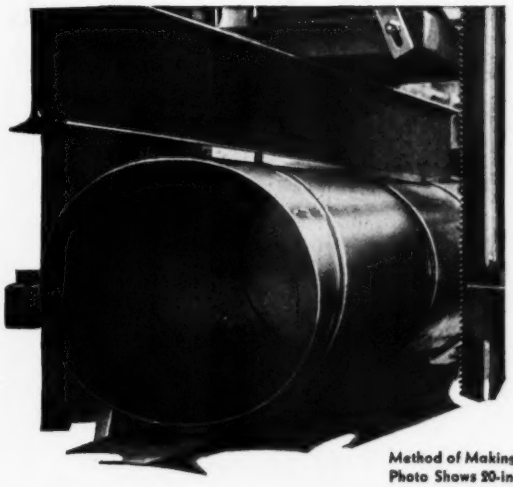
Be sure and remember Nordberg Machines whenever the 1931 budget is considered!

NORDBERG RAIL DRILL

NORDBERG MFG. CO.
MILWAUKEE
WISCONSIN



NORDBERG TRACK SHIFTER



Method of Making Crushing Tests.
Photo Shows 20-inch Naylor Pipe.

Authoritative Tests Prove Remarkable Resistance To Crushing Action In LIGHT WEIGHT Naylor Pipe

External crushing tests on Naylor Pipe recently conducted by Professor M. L. Enger and W. M. Lansford at the Materials Testing Laboratory of the University of Illinois show:

Diameter In.	Thickness In.	Load at Yield Point Lb. per Ft.	Vertical Defl. Yield Point In.	Max. Load Lb. per Ft.	Computed Load at Yield Point Without Spiral Joint Lb. per Ft.
6	0.109	4000	0.24	7100	1010
12	0.141	2800	0.45	4200	930
20	0.141	1000	0.45	2000	580

The last column in the table gives the computed load required to stress to the yield point a plain pipe of the same thickness as Naylor Pipe. A comparison of these values with the experimental values obtained on Naylor Pipe brings out clearly the stiffening effect of the Naylor *Spiralweld* lock-seam.

Another feature of Naylor Pipe structure disclosed by these tests is its ability to transmit loads at considerable distances along the length of the pipe due to the flexible *Spiralweld* lock-seam construction. As a result, loads applied to small areas of the pipe would have to reach relatively large values to bring about a collapse of the length which would be affected.

These authoritative tests are indisputable evidence that remarkable resistance to crushing action has always been one of the definite features of *light weight* Naylor Pipe. A fact that Naylor Pipe has demonstrated in the field. Catalog 30-2 gives more complete engineering and metallurgical data.

NAYLOR PIPE COMPANY, Main Office & Plant, 1230 E. 92nd St., CHICAGO

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MONTREAL, CANADA: Mechanical Equipment Company, 660 St. Catherine St., West

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Exclusive Distributors:
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Apartado 284
Monterrey N. L., Mexico
Representative in Mexico

TONCAN COPPER

Naylor Pipe

Maximum Structural Strength Mo-lyb-den-um With Minimum Weight

IRON

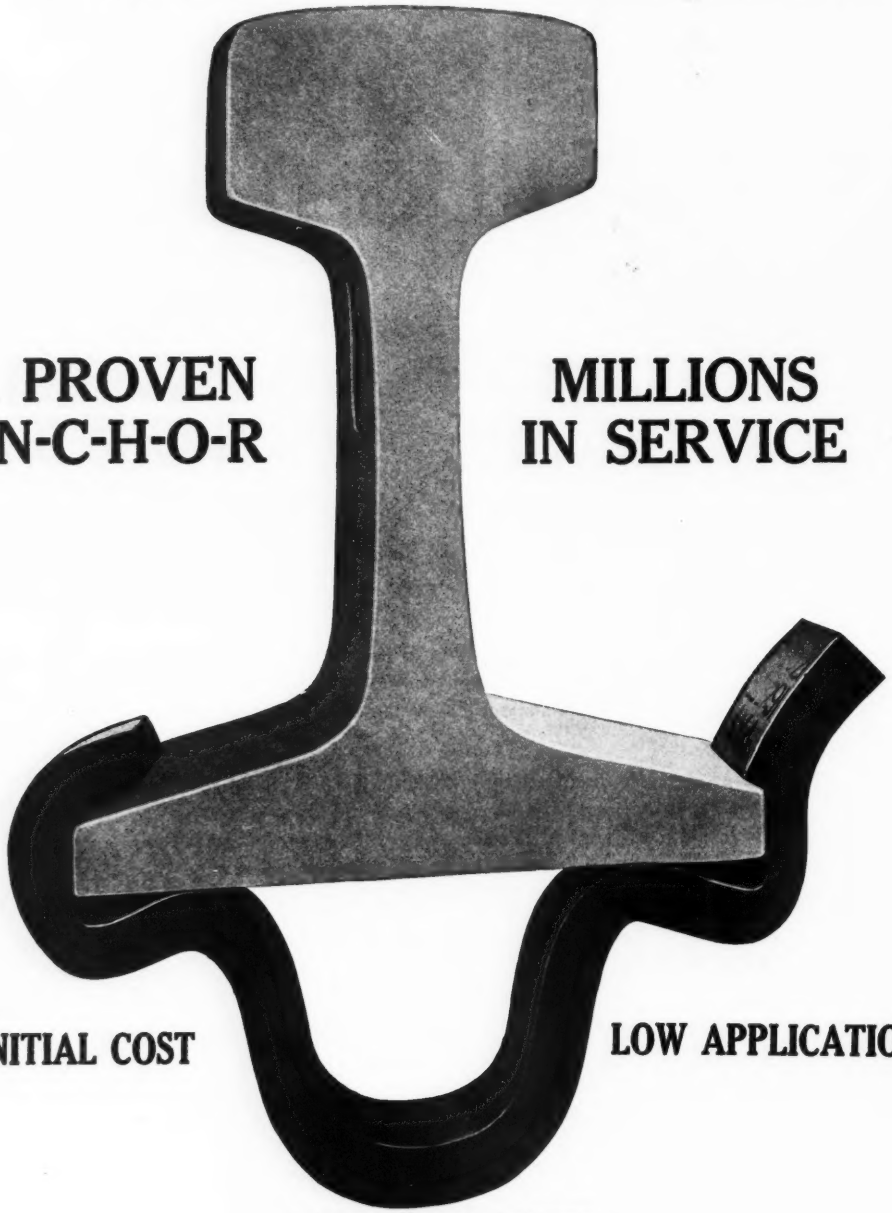
Standardized Naylor Pipe is made in sizes 6" to 12" I. D. and 14" to 20" O. D. in any uniform length desired up to 40'0". Ends made to wrought pipe standards for all types of coupling.

Toncan Copper Molybdenum Iron possesses a superior corrosion resistance, making it the favored pipe material.

Where corrosion is not a problem, Naylor Pipe can be furnished in steel.

R-A-I-L-R-O-A-D-S

I-N-C-R-E-A-S-E Y-O-U-R P-R-O-F-I-T-S B-Y U-S-I-N-G W-O-O-D-I-N-G-S R-A-I-L A-N-C-H-O-R-S



A PROVEN A-N-C-H-O-R

MILLIONS IN SERVICE

LOW INITIAL COST

LOW APPLICATION COST

CAN BE REAPPLIED
DOES NOT DAMAGE RAIL OR TIE

WWOODINGS FORGE & TOOL CO. W

WORKS AND GENERAL OFFICES

VERONA, PENNA.

Lower Maintenance-of-Way Costs

with Double-Length Rail

USE of oxy-acetylene welding to double-length standard 39- or 33-ft. rail, halves the number of joints per mile and cuts maintenance-of-way costs. By making it possible for railroads to fabricate their own extra-length rail wherever and whenever it is needed, Oxwelding eliminates the difficult problem of handling such rail from mill to roadbed.

Oxwelded joints are 100 per cent batter-proof, as strong as, or stronger than, the rail itself. They are the only joints that will withstand present-day axle loads and train speeds without rail batter.

The Oxweld Railroad Service Company, qualified by 18 years of experience in railroad Oxwelding, is prepared to furnish the best and most economical methods, materials, and supervision for the performance of this work.

OXWELD RAILROAD SERVICE

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

NEW YORK
Carbide and Carbon Bldg.

UCC

CHICAGO
Carbide and Carbon Bldg.

ELECTRICITY IS THE MODERN POWER

TAMPING TIES

To surface track economically and efficiently, consider the time lost by the tamping gangs in moving big heavy equipment, waiting for the use of track or a work train crane to move it, distributing and connecting heavy pipe and hose.

SYNTRON TIE TAMPER POWER UNITS are small and light in weight and can easily be moved on their dolly wheels along one rail by a small crew in a few moments or where the traffic is heavy by rolling along planks on the shoulder of the track without using the rail.

SYNTRON TIE TAMPERS are simple electro-magnet hammers that strike a constant blow regardless of age, wear or weather, nor are they effected in their power by the skill of the operator or the effort he applies against them.

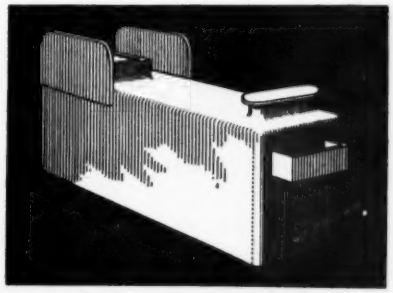
The Tie Tamper Power Units will operate many other power track tools providing year around use of the equipment.

Built in 4, 6, 8, 12-tool outfits

SYNTRON COMPANY, PITTSBURGH, PA.
15 Factory Service Branches

Keeps switches open through hardest blizzards

WINTER KING Switch Heaters keep switches open and trains moving, in the worst blizzard conditions. The switches shown in the illustration at the right were kept open by Winter King Switch Heaters throughout a 48-hour blizzard, accompanied by a temperature of 13 deg. below zero, a 50-mile wind and an 18-in. snowfall, in January, 1930. These heaters are installed in the largest interlocking plant in the United States, operated by the Terminal Railroad Association at St. Louis.



The Winter King Switch Heater is made of copper-bearing steel. The standard size is 18 in. long by 4½ in. wide by 5½ in. high or a total height of 7½ in. to the top of the guard. Heaters are shipped with wick installed, ready for immediate use. It is necessary only to place the heater beneath the switch point, fill with kerosene and light the wick.

The Winter King Switch Heater

4,000 Winter King Switch Heaters were used in this yard last winter and gave complete satisfaction.

Substantial savings in snow removal costs are to be had by the use of Winter King Switch Heaters. Where these heaters are installed the cost of snow removal is about one-third of that by the hand method. One man can take care of about 100 heaters.

The Winter King Switch Heater is made of copper-bearing steel. It consists of a steel box with two compartments; a combustion chamber containing a mineral wool wick and a fuel chamber of about 1½ gal. capacity. In the top of the combustion chamber there is a large wick opening which permits the heat to flow around the switch point and stock rail. Write for literature.

BETHLEHEM STEEL COMPANY

General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Cleveland, Detroit, Cincinnati, Chicago, St. Louis. *Pacific Coast Distributor:* Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

BETHLEHEM

No. 23 of a series

PUBLISHER OF
RAILWAY AGE
RAILWAY MECHANICAL ENGINEER
RAILWAY ENGINEERING AND MAINTENANCE
RAILWAY ELECTRICAL ENGINEER
RAILWAY SIGNALING
MARINE ENGINEERING AND SHIPPING AGE
THE BOILER MAKER

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

"THE HOUSE OF TRANSPORTATION"

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SAN FRANCISCO 215 MARKET STREET

ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Direct Mail

October 30, 1930

Dear Reader:
Everywhere

When I returned to my home recently from a three weeks' trip, I was struck with the amount of mail that had accumulated during my absence. When I opened this mail I was even more impressed with the fact that among the more than 75 different pieces there were only 6 or 8 letters of personal interest, the remainder being sales literature of one kind or another which went into a handy wastebasket. This experience caused me to wonder what the waste must be in the office of a railway officer.

On investigation, I found that one of the members of our organization had just made a check of the mail that was received in the offices of two purchasing agents, the results of which may be of interest to you. On one road our representative rescued 427 different pieces of sales literature from the wastebasket of the purchasing agent in a period of two weeks, including 178 duplications. Eliminating the latter, 249 different pieces of literature were so discarded, an average of more than 20 a day. In the office of another purchasing agent, a total of 212 pieces of direct mail sales literature were taken from the wastebasket in one week, including 42 duplications. When I saw these figures, the thought occurred to me that if these purchasing agents spent only five minutes examining each piece of this literature, they would spend a quarter of their time at this task, an obviously impossible burden. The wastebasket was the obvious answer.

Associated as I am with a publication which goes to the large group of railway officers who specify and purchase the materials and equipment which are employed in the construction and maintenance of railway tracks and structures, and which carries a large number of advertising pages bound in with the editorial pages, I could not help but think of the contrast in disposition. Who ever heard of a man throwing into the wastebasket the magazine for which he subscribes and pays his good money?

Yours very truly,

Elmer T. Howson

ETH*JC

Editor.

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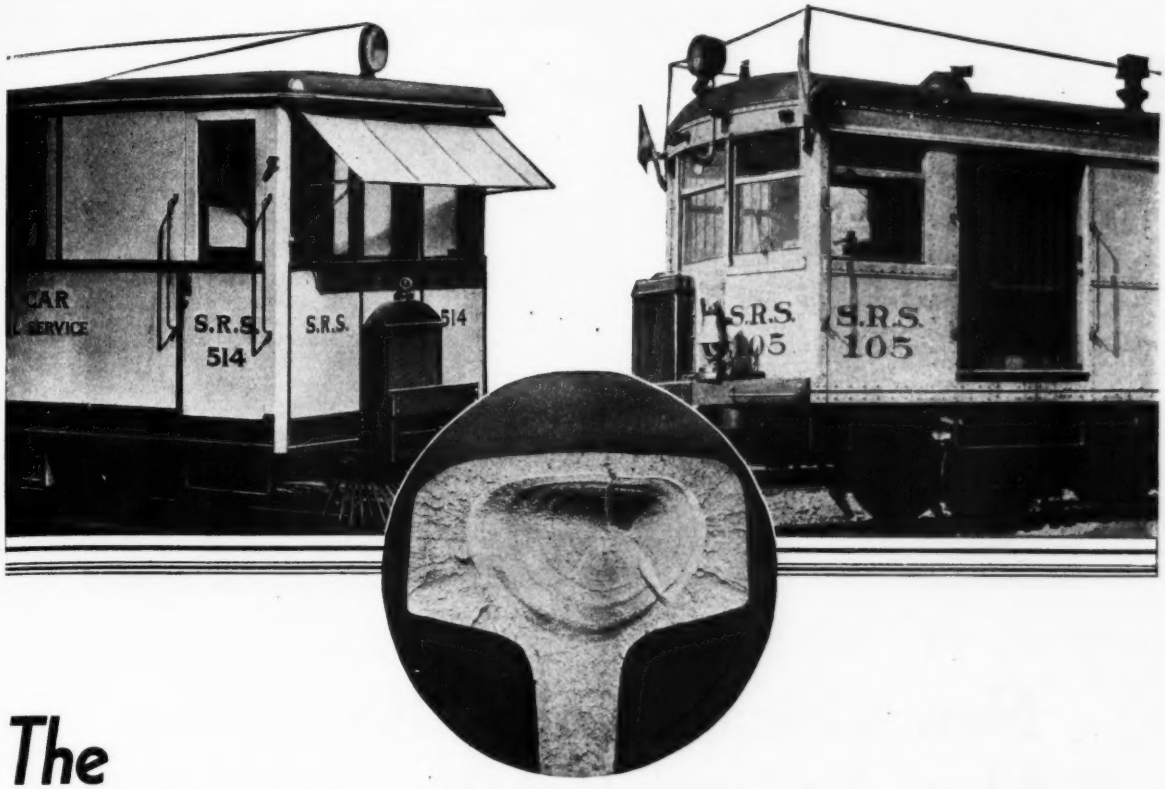


The SPERRY DETECTOR CAR

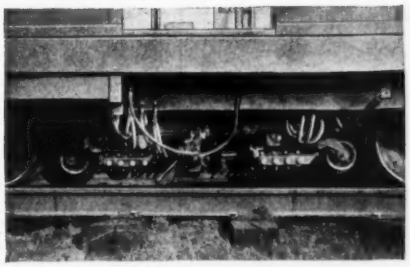
Solves the problem of finding hidden Rail Defects...

NO outward sign tells the location of internal fissures in rail. But they exist, and to locate them before failure has been a puzzling problem.

Now, by an ingenious use of electricity and highly sensitive instruments, the Sperry Detector Car, developed by Dr. Elmer A. Sperry and his staff of engineers, makes it possible to detect hidden defects of all kinds in rails.

Moving over the track at 6 miles an hour, these cars locate transverse fissures and other rail defects such as split heads, pipes, cracked webs and moon breaks. They make an ink record for railroad use. They paint-mark rails to facilitate locating. Even the size of the defect, whether large or small, is given by this accurate rail-testing method.

Sperry Rail Service mans its cars with crews of trained operators—experts on rail testing. Co-operating with railroad representatives, they locate internally defective rails, giving ample opportunity to remove them from track, thus assuring railway safety and eliminating the possibility of damage to property.



Brushes, especially designed to make an excellent contact, conduct energizing current to the rails. A pick-up device detects the presence of a defect and transmits it after amplification to recording pens.

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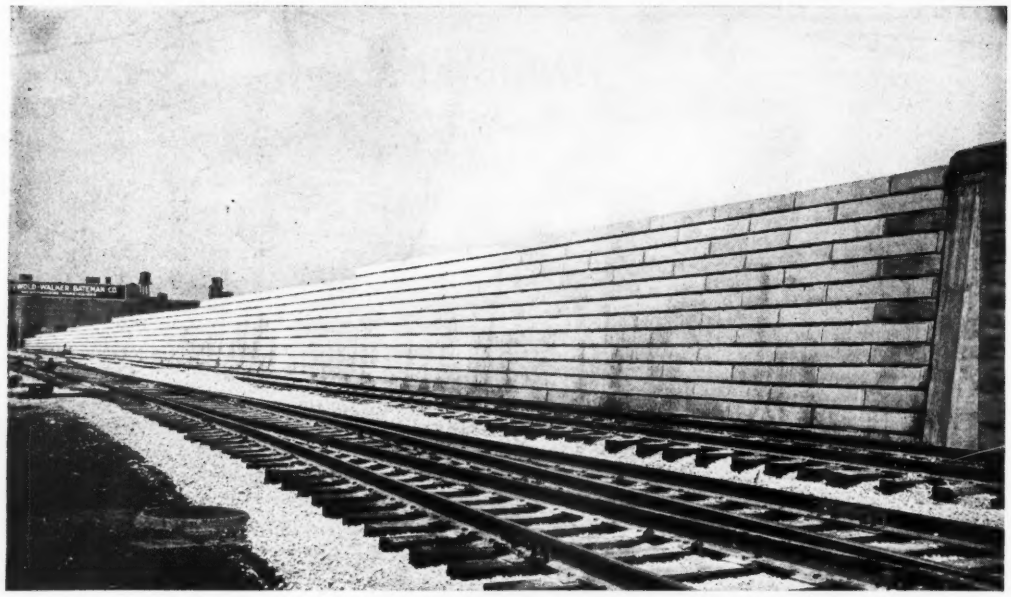


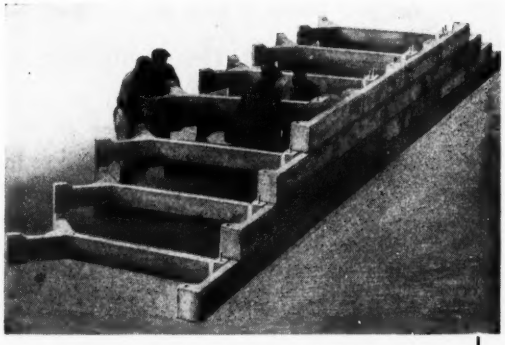
Retaining Wall for grade separation of the joint tracks, Burlington and Northwestern, Chicago, of Federal 2-Piece Concrete Cribbing.

New Chicago Grade Separation Uses Federal Retaining Walls

Supporting the road-bed as solidly and permanently as a poured concrete wall — adding the greater beauty of fine masonry — *yet all this at less cost* than poured concrete — are sound reasons for the use of Federal 2-Piece Cribbing on *any* retaining wall project.

The wall on the Chicago grade separation shown above is duplicated on the other side of the road-bed. Since these walls were erected, a similar wall for another road has been ordered, as part of this same project.

More and more prominent roads over the country are taking advantage of the extra value offered by Federal 2-piece construction. Why not allow our engineers to present the data for your own comparisons? Booklet on request.



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These precast units come to the location ready to lay, being simply unloaded direct from car to wall. Cold weather is therefore no bar — the units are handled as readily — erection goes on as easily — in winter as in summer.

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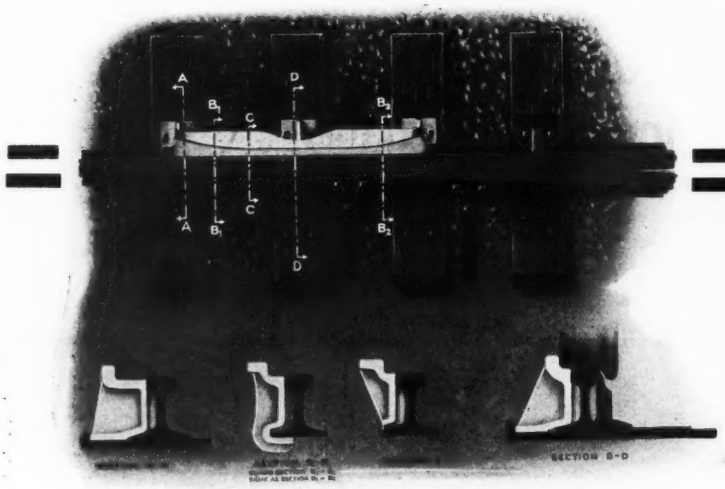

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In service, the flange bears against the tire of the passing wheel as shown in "Section D-D," guiding the wheel flange past the thin tip of the switch point without contact or wear; thus the life of the switch points is prolonged.

This is particularly important in the case of facing switches where points must be in the best condition to prevent split switches.

The guard is easily installed. When supported by extra long switch plates the gage is maintained independently of the running rail and maintenance is virtually eliminated.

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Railway Engineering and Maintenance

Volume 26 November, 1930 No. 11

Remove Defective Rails

TRANSVERSE fissures have been the subject of serious study by maintenance officers ever since their presence in open hearth rails was first disclosed. The greatest advance in this study was made when the Sperry detector car was developed as a result of the widespread demand for some means of determining the presence of such fissures in advance of the failure of rails that are afflicted with them. In general, the railways have been alert and quick to take advantage of this new means of inspecting rails in service. Without doubt, numerous accidents have been avoided through the removal of rails which were found to contain transverse fissures, although there is no way of determining how many this may be.

The recent experience of one road which is using the detector car is of interest and contains food for thought. In passing over a certain rail, three indications were given, one for a small fissure and two for the intermediate size. One of these was within the limits of the joint and an examination of the rail showed that the other two were located at points where the rail had been burned by the slipping of locomotive drivers. For this reason, it was assumed that the first indication was a part of the normal joint indication and that the other two were caused by the surface defects which were found. Because of this assumption the rail was not removed, but was marked for observation.

Before the detector car made its next trip, the rail in question broke under a passenger train, exactly at the points indicated on the record, and each break showed well developed transverse fissures of the relative sizes indicated by the record. Fortunately, the train was not derailed and no damage was done other than to the rail, although the potential ability to cause a serious accident existed in the rail.

The lesson to be learned from this and numerous other similar instances is that a defective rail is a defective rail and should not be allowed to remain in the track. It is true that, owing to improvements which are being made constantly in the detector car as a result of experience, the scope of the detecting device is being enlarged and that many defects entirely different from transverse flaws are being recorded; yet a defective rail, whatever the character of the hidden defect, is a potential source of danger and should be replaced.

Dependable Service

When a highway is paved, the road is closed to traffic. When an automobile manufacturer launches a new model, he often shuts down his plant to install new machinery. When rivers are low, barge lines stop running. But when a washout or a train accident blocks a railway its employees work night and day until traffic is resumed.

This dependability of railway service has come to be so generally accepted that it is never questioned. Perhaps this is the reason why public officers turn first to the railways in times of national disasters or economic crises. It may be more fun to take a vacation trip in an automobile, but when blizzards block the highways and the temperature is way below zero, it is a comfort to know that No. 6 will be on schedule and the coaches will be warm.

Why Not a Welding Engineer?

THROUGH economies which it has effected in reducing track maintenance and prolonging the life of rail, the building up of battered rail ends, frogs and switches by electric and oxy-acetylene welding is constantly receiving more attention and greater application. Furthermore, the butt-welding of rails at certain locations is becoming common practice on some roads and in view of the tendency toward longer rails, it is possible that this practice will be still more extensive in the future. The fabrication of structural steel for bridges and buildings by welding is being advocated on the railways as elsewhere. It is thus evident that welding operations are becoming more and more of a major maintenance of way activity of the railways.

The application of welding to railway work is comparatively recent and, as in the case of most processes of recent introduction, new developments and applications are apt to come in rapid succession. While the service departments of the various manufacturers of welding equipment may be expected to keep the roads informed of these new developments in the art of welding, such departments have certain limitations and should not be relied on entirely. In addition to the above considerations of welding in railway work, there are also such others as standardization of practice, the development of a stable and efficient organization, centralization of responsibility, the equitable distribution of the welding forces, closer supervision, etc.

In view of the above considerations, it seems appropriate to suggest that at least some of the roads may now find it advisable to place the responsibility for the efficient and economical conduct of their welding operations in the hands of one whose time and attention are not taken up by a multitude of other responsibilities and duties of perhaps a more

pressing nature. Such a man would of necessity be a welder of broad experience and in close touch with the industry. He would have an intimate knowledge of the needs of the road which he served, and would thus be in a position to direct and control the welding operations to secure the greatest efficiency and economy and the greatest possible benefit. With these considerations in mind, maintenance of way and engineering officers might do well to investigate the efficiency of their present welding organizations to determine whether the salary of a man in direct charge of all welding operations would not be justified through increased efficiency and economy.

A Special Case of Manufacturing

THE REPORT of the Committee on the Inspection and Repair of Turntables, presented on page 506 in the report of the Bridge and Building convention, contains the statement that some railways make their own turntable centers. In the absence of comment by the committee on this practice, this statement might lead to an incorrect impression, for, surely, manufacturing of this kind is limited to an exceedingly small number of railways. Many railways, when awarding contracts for turntables, order centers built to the fabricating company's standard designs, while other railways have obtained highly commendable results with turntable centers built according to their own plans. However, few railways find that there is any advantage in building such special equipment in their own shops.

In the first place, the demand for turntable centers is so intermittent that an order placed with the railway's mechanical department necessarily falls under the heading of special work and is subject to all the disadvantages incident to any job that does not embody routine methods and processes. Special instructions must be given to the men and special jigs and tools must be provided. Furthermore, such a job imposes requirements that are not encountered in the usual work of the motive power and car shops. The requirements of bearing metals for slow-moving, high-pressure, turntable machinery are entirely different from those exacted of car journals or locomotive machinery. While the manufacture of such special equipment by a railroad's own forces may be justified under certain conditions it would appear that this would be true only in the exceptional case rather than under normal circumstances.

Remodeling Passenger Stations

THE situation which confronts the railways with respect to their small or moderate size passenger stations is one that presents a sharp contrast. Although the local passenger station has been for fully ten years the source of steadily decreasing revenue, there has been no let-up in the public demand for "bigger and better" stations that will serve adequately to gratify local vanity. That there are many stations which are not a credit to the railroads which own them is conceded. Built at a time when the vogue in American architecture was at its worst, many of them violate the simplest rules of artistic taste. But of a more practical nature is the fact that the heating, lighting, ventilating and sanitary appurtenances are of a rather primitive character and that, in spite of periodic repairs, the buildings show the ear-marks of many years of hard wear, while the floors and walls are of a type that defy efforts to keep them clean and presentable.

Thus, the old passenger station has become a hard nut for the railroads to crack. It is the butt of local jokes and more often the object of bitter criticism, and although few of the residents of the town ever spend as much as a dollar at the ticket window, they clamor constantly for a new structure. It is not a problem of making one investment that promises limited return, but is necessarily multiplied many times because the replacement of one station simply establishes a precedent for similar projects elsewhere.

Because the problem rarely involves the factors of increased size or altered arrangement or physical deterioration of the structural frame, interest has natually turned to the possibilities of reconstructing, or, more properly, redressing old stations and, as pointed out in the report of one of the committees at the Bridge and Building convention, appearing on page 504 of this issue, some railways have successfully forestalled the demand for new stations by restoring the old ones.

Whether or not this is the answer in any given case depends on many things, for, as shown in the report, the cost of making alterations in some cases exceeds the cost of a new building of the same size. Furthermore, half-way measures can hardly be justified, for if the change is not of a nature that will give the structure architectural character of a lasting quality, or if the materials used are of a type that will not withstand the heavy usage to which a station is subjected, the expenditure will serve merely to postpone the demand for a new station. It is in respect to some of the factors outlined above, that the building maintenance officer is in a position to render real service to the management of his railway, because he, more than anyone else, is in a position to know what type of floors, what character of plumbing fixtures and what treatment of walls have been found best to meet the exacting requirements of the particularly severe service imposed in railway stations.

A Note of Caution

SUCCESS attending the introduction of a new type of construction, a new process or a new device easily gives rise to the conclusion that it offers the solution for all the problems that were encountered with that which has been superseded. As a consequence, the enthusiast frequently endows the new development with attributes and advantages not claimed by those who are promoting it. This thought, while not expressed directly, evidently prompted some of the discussion of the report on concrete crib walls, reported on page 500 of this issue. While conceding the merits of this type of construction, several speakers sounded a note of caution and pointed to the difficulties that may be encountered if too much is expected of the new types of retaining wall.

Several types of reinforced concrete precast retaining walls have been developed and have evidenced a remarkable adaptability for various applications, and they have been applied at a marked saving in cost as compared with built-in-place walls. One outstanding advantage of this construction is the fact that it can be used successfully without need for the construction of costly footings and, as reported at the convention, they have been built to heights of 18 ft. or more. But this does not mean that there are not locations where it would be advisable to provide footings or where it would be wise to place limits on the height of the wall.

These suggestions express the prevailing attitude of the manufacturers who realize that failures resulting from unwise applications will do more to retard the legitimate application of this form of construction than a spirit of reasonable conservatism on the part of the prospective user.

Two Policies

AFTER meeting in Chicago for the last two years, the members of the Roadmasters Association voted without a dissenting voice at their convention in September to return to that city for their meeting next year. A month later the members of the Bridge and Building Association, at their convention in Louisville, Ky., rejected a suggestion that they meet in a similarly central point and selected a Canadian city, Toronto, for their 1931 meeting. To indicate still more definitely their aversion to a central meeting place, they voted down a further recommendation that they meet in Chicago every second year.

This divergence in attitude is even more striking if one compares the movements of the two organizations in recent years. In the last five years the Roadmasters have met in Chicago on three occasions and at Buffalo, N. Y., and Detroit, Mich., in the other two years. The Bridge and Building men, on the other hand, have not met in Chicago, or any other equally central city, for more than eight years, and in the interval have convened at such remote and widely separated points as Seattle, Wash., Richmond, Va., Minneapolis, Minn., Boston, Mass., and New Orleans, La.

Such a contrast in the policies of two organizations that are so important and so comparable is of interest and concern to engineering and executive officers at any time. This is especially true under present conditions when so many railways are watching their expenses so closely and to this end are discouraging all unnecessary absence from work and traveling by their men.

In selecting Chicago as their convention city, the Roadmasters have been influenced primarily by its central location. In this respect, they are following the precedent established by the American Railway Engineering Association which has adhered steadfastly to a fixed central place of meeting throughout its existence, with results that speak for themselves. The roadmasters have found that more of their members can reach this city with minimum travel than any other city in the county. Furthermore, more of them can go to Chicago without putting their roads to the trouble of securing foreign transportation for them.

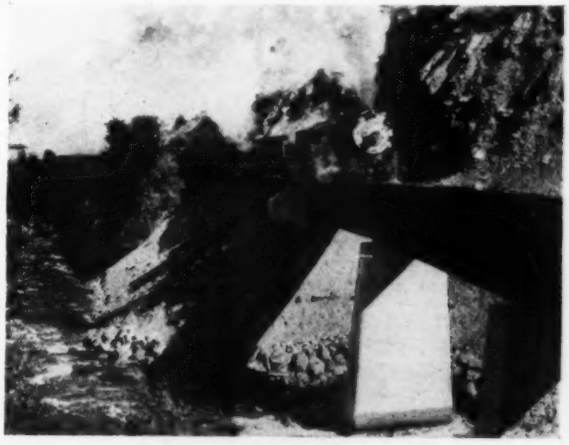
In meeting in more widely separated parts of the country from year to year, the Bridge and Building men advance the argument that, as the convention is brought to different areas it is possible for more present and prospective members in those vicinities to attend the meetings, and that membership is stimulated thereby. While there is no question but that the attendance is larger proportionately from those roads in the vicinity of the convention, this is in reality an argument for a central location. Furthermore, this argument overlooks the fact that the movement of the association to outlying areas increases the difficulty of attendance for members from other parts of the country and tends to decrease their interest.

As with other differences in practices, their relative merits are best shown by the results. One such indication should be the trend in membership. Comparing the number of members paying dues in 1925 and in 1930, the Roadmasters Association shows an increase of 213 members, while the Bridge and Building Association shows a decrease of 49. Likewise, in attendance at the conventions, the Roadmasters have in recent years consistently shown an attendance 50 per cent greater than that of the Bridge and Building Association, although the number of members in good standing has been approximately the same.

This contrast in policies is also reflected in the interest taken by the supply companies in the presentation of exhibits coincident with the meeting. At the Roadmasters convention this year, 68 manufacturers of track materials and equipment occupied some 20,000 sq. ft. of floor space with motor cars, track tools and other equipment actually used in railway work. The educational value of these exhibits is evinced by the number of railway men who, although not directly concerned with the convention, visited the exhibit to see the materials on display. Likewise, the value of this exhibit to the manufacturers is evidenced by the fact that the number of companies exhibiting and the area occupied by their exhibits have increased steadily from year to year and, in spite of present business conditions, were this year the largest in the history of this supply association.

At the Bridge and Building convention, few of the manufacturers have made it a practice to display their equipment because of the expense of shipping it to outlying points. Rather, by reason of the migratory policy of this association, they have come to confine their exhibits principally to catalogues, literature and souvenirs. As a result railway men find less of educational value in the exhibit and the attention given the exhibit is correspondingly smaller. This is also evident in the number of manufacturers participating, their number having declined nearly one quarter in the last four years and the floor space to an even greater degree.

There has never been a time when more has been required of railway men than now, or when the demand for maximum results has been greater. Equally pressing are the responsibilities resting on the officers of the railway associations to serve the roads most efficiently and with the least expenditure of money and of time.



High Bridge Near Watts, Colo., on the Denver & Rio Grande Western

Operating

The right way to remove a car from the track—the skid helps

Part II

*The prevention of derailments, handling to and from the track, starting, getting on and off**†*

By C. R. KNOWLES‡

ACCORDING to the tabulation in the preceding article, 15 per cent of the motor car accidents are due to derailments. If we include those derailments caused by tools or other objects falling from the car and by striking animals, the total is increased to 20 per cent, or one-fifth of all causes.

The four principal factors contributing to the derailment of motor cars are: The speed of the car; failure to observe the track ahead of the car; poor condition of the car; and improper loading of tools or other material.

Speed is not only a contributing factor in derailments but also in the resulting injuries and damage, for a derailment at moderate speed may cause no personal injuries or damage while one at high speed may have very serious results. Derailments that are the direct result of speed are those occurring at frogs, switches, derails, road crossings, and at points where a clear view cannot be had of the rail, as, for example, where the track is overgrown with vegetation. Failure to observe a reasonable rate of speed invites a derailment.

By carefully watching the rails ahead of the car, one will usually discover any object on the rail that might cause a derailment. It should be the duty of the operator of the car to keep this lookout but he should also be prepared to stop quickly at a signal from other occupants of the car. In order to avoid confusion there should be a pre-arranged signal to indicate that an obstruction threatens the safety of the car.

Derailments from unknown causes may invariably be traced to the poor condition of the car, loose wheels, sharp flanges, poor alinement, bent axles and a loose condition of frame, bearings and thrust collars are often responsible for motor car derailments attributed to unknown causes; such accidents can be prevented by careful inspection and adjustment of loose and worn parts.

Perhaps none of the tools that were dumped on this car will fall off—but careless loading invites disaster

*This is the tenth of a series of 15 or more articles on the Care and Operation of Motor Cars, the first of which, on the Place of the Motor Car in Railway Work, appeared in the January issue, page 5, the second on the type of Motor Car, in the February issue, page 54, the third, on the Motor Car Engine, in the April issue, page 158, the fourth, on How a Motor Car Is Built, in the May issue, page 214, the fifth, on Proper Lubrication, in the June issue, page 248, the sixth, on Ignition, in the July issue, page 295, the seventh, on the Care of Motor Cars, in the August issue, page 339, the eighth, on How to Secure Efficient Operation from a Motor Car, in the September issue, page 376, and the ninth, on Motor Car Accidents, in the October issue, page 416.

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‡Mr. Knowles is in charge of the operation and maintenance of motor cars and other gasoline-operated work equipment on the Illinois Central System.

Motor Cars Safely

The careless loading of tools that results in their falling from the car is responsible for a large number of accidents. Derailments caused by objects falling from the car can be prevented by establishing a systematic method of loading water kegs, track jacks and other tools and materials.

Derailments due to striking animals are perhaps the most difficult of all to avoid, especially the smaller animals such as hogs and dogs as they are likely to run in front of the car before they are seen. The operator should be prepared to stop before passing any animal near the track and should run cautiously wherever a view of the right-of-way is obstructed by weeds, as a startled animal will invariably run across the track.

There is little excuse for a derailment of any kind and less for one that results in a personal injury or in damage to the car. Conditions which may cause a derailment are almost always apparent and can be anticipated and avoided by a live, alert motor-car operator.

Handling Cars On and Off Track

Motor cars must be placed on and off the track at frequent intervals, and in order to avoid accidents in doing so they must be handled in an intelligent orderly manner, and haphazard methods avoided. Injuries that occur in handling motor cars are rarely fatal and the importance of their control is often over-shadowed by the more spectacular accidents due to collisions or derailments.

They consist chiefly of crushed feet, broken legs and strains that often result in hernia. In many cases the cause of the accident is disposed of by charging it to clumsiness on the part of the injured man. These accidents are entirely too numerous and uncalled for and can be eliminated by proper training and ordinary care.

It is rarely necessary to lift the entire weight of the car when placing it on or off the track as in the routine operation of the car it is usually possible to select a set-off or road crossing. Almost the only exception is when it becomes necessary to remove the car in the face of an approaching train, an emergency that can be avoided through proper observance of the rules of safe operation.

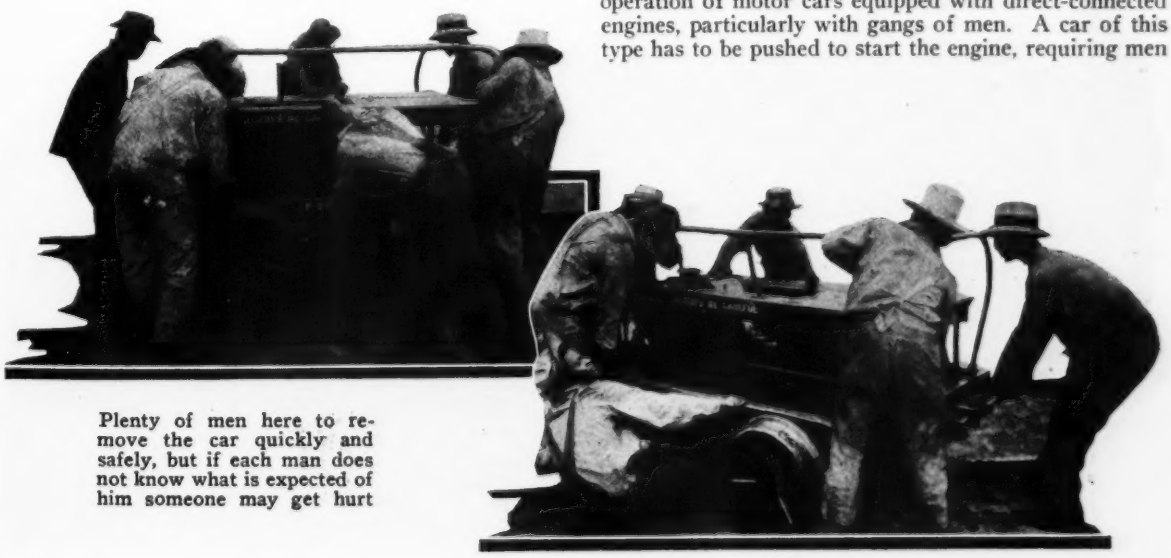
Two men should be able to handle an ordinary motor car on and off the track at a road crossing or set-off, while four men may be required with heavy-duty cars or with the ordinary section car on open track. A limited number of men properly trained will handle the car with greater ease and safety than a dozen men working in a haphazard manner.

Certain men should be assigned the duty of placing the car on and off the track. It should be definitely understood how the car is to be handled and each man should know what is expected of him. Other men in the gang should be instructed to stand aside and take no part in handling the car unless told to do so, as they not only interfere with the prompt handling of the car but increase the possibility of injury by force of numbers and the confusion resulting from men crowding about the car and getting in each other's way.

Car set-offs, properly constructed and maintained, add to the safety of motor-car operation as well as prevent abuses to the car from dragging it over the rail and ties on open track.

Extension lift handles and rail skids may properly be classed as safety features designed to reduce the hazard of handling motor cars. These handles are so designed that they may be extended quickly, increasing the leverage from three to four feet, this additional leverage materially reducing the lifting weight of the car. Rail skids consist of rails placed inside the wheel flanges on each side of the car parallel to the rail and slightly above it. They are securely fastened to the side sills of the car frame and extend from wheel to wheel. They facilitate the removal of the car by eliminating the necessity of lifting the rear wheels over the rail when handling the car on open track as well as preventing damage to pulleys or other parts of the car extending below the deck.

There is always a certain hazard of accident in the operation of motor cars equipped with direct-connected engines, particularly with gangs of men. A car of this type has to be pushed to start the engine, requiring men



Plenty of men here to remove the car quickly and safely, but if each man does not know what is expected of him someone may get hurt

to board the car while in motion, with the possibility of their stumbling and falling while pushing the car or in attempting to get on it. This type of car also presents a hazard in operation owing to the difficulty of running at a low speed at points where the view may be obstructed, as at a highway crossing. As a result, the operator will often take a chance for fear of stopping his engine, since this necessitates pushing the car to start it again.

Extreme care should be exercised when starting direct-connected cars. Experienced men should be designated to push the car and they should be allowed ample time to board it before it has attained a speed of more than six or eight miles per hour. These men should board the car from the rear only, and never from the sides or front. Occupants of the car should allow them ample room to get on the car as easily as possible without interference.

Exercise Care in Pushing Cars

If the engine does not start readily and it is necessary to push the car for any considerable distance, consideration should be shown the men pushing the car to avoid the possibility of their becoming exhausted and increasing the liability of their being injured. This is particularly true in hot weather. The hazard of injury is also increased in cold weather when the men are hampered in their movements with overcoats or other heavy clothing. Cold weather also increases the hazard due to snow and ice on ties.

The men engaged in pushing the car should be warned of the proximity of switches, cattle guards, road crossings, open trestles or any other obstruction in the track that might cause them to stumble and fall.

Light inspection cars with direct-connected engines are not as hazardous in operation as gang cars, as fewer men are involved and they are not so hard to start. However, a certain amount of care is necessary with even these lighter cars equipped with direct drive if accidents are to be avoided, and the same precautions should be followed as with the gang cars where the same rules apply. When a direct-drive light car is operated by one man, precautions should be taken in starting the car to insure that it will not get away from the operator and run wild, as serious accidents have occurred in this manner. In starting a car of this kind, the ignition should not be on until the car is in motion and the operator aboard.

Injuries are not uncommon in starting cars with free running engines, for cars of this type are often started by throwing the engine into gear and pushing the car. This practice offers the same hazard as a direct-connected engine, and should be discouraged.

Injuries also occur in cranking the engine and in starting it by turning it over by the flywheel. In cranking an engine to start, the spark should be properly retarded to prevent the engine from kicking back. As a further precaution against injury, the crank should be in a position so that it will be pulled against the compression for, in the event that the engine should kick back while the operator is pushing the crank against compression, it is liable to break the wrist or arm, while if he pulls on the crank it will result in it being jerked from his hand with much less liability of injury.

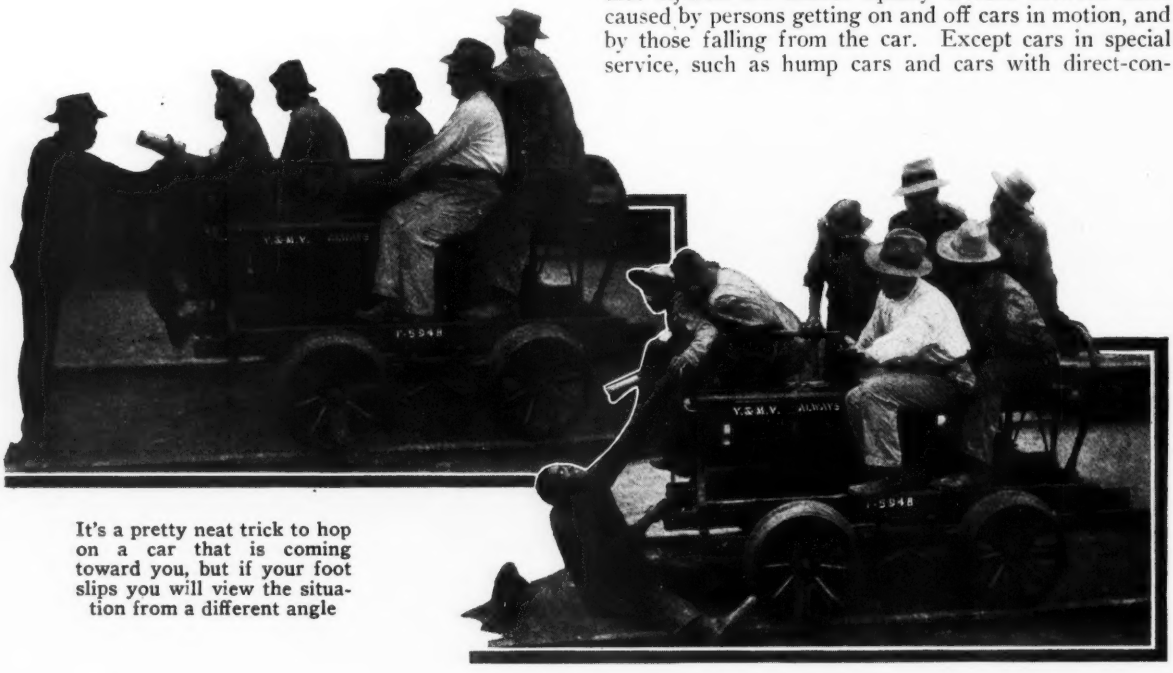
Turning an engine over by the flywheel to start it is not objectionable on small engines where there is sufficient room and the wheel is not difficult of access. As a rule there is little flywheel clearance on a motor car engine and, as a result, there is danger of getting the hand or arm caught when starting the engine in this way.

Some motor car engines are started with a knotted cord or rope which is passed around a grooved wheel similar to a narrow sheave. This is probably the safest and most convenient method of starting engines by hand but it can be used only on very small engines.

An electric starter, of course, provides the ideal method of starting gasoline engines, from the standpoint of safety, but it not only adds materially to the weight of the car but is too expensive for the ordinary motor car and it is, therefore, used only on certain types of heavy-duty and large party inspection cars.

Getting On and Off Cars in Motion

The record showing the causes of accidents indicates that injuries are almost equally divided between those caused by persons getting on and off cars in motion, and by those falling from the car. Except cars in special service, such as hump cars and cars with direct-con-



It's a pretty neat trick to hop on a car that is coming toward you, but if your foot slips you will view the situation from a different angle

Perhaps they think that these are new and improved ways of riding on a motor car, but they have all been tried before—with disastrous results. What about the lookout to the rear? How many other rules are being violated?

nected engines, there is no reason why men should get on or off moving motor cars and the practice should be prohibited.

Hump cars are designed to permit car riders to board them in motion and they are equipped with footboards and grab irons to lessen the hazard of injury. The rule should apply particularly to direct-connected cars except in starting, as men are especially inclined to get on and off a car of this type while it is in motion owing to the reluctance of the operator to stop, since this requires men to dismount and push the car to start it again. While it is true that the men who push the car will have to board it in any event, the hazard is reduced as they will get on from the rear if properly trained.

Injuries due to falling from motor cars are the result of crowding or of men scuffling, changing position, or standing up on the car. Where regular gangs use a car, each man should have a designated place on the car, and every man should be in his place before the car is started. Disorderly seating of men and crowding should be avoided and scuffling or play should not be permitted. Men should not be permitted to sit on water kegs, boxes, or any place other than the regular seat of the car. They should not be allowed to move about or change their position on the car while it is in motion. New men in the gang should be instructed in regard to safe, orderly conduct on the car, and the men older in service cautioned against becoming careless.

Every precaution should be taken to prevent a panic in the event of a real or fancied emergency, as for example if the car should catch fire or a torpedo explode. If danger is imminent and it is necessary for the men to jump, they should be cautioned against jumping in front of the car.

Novel Weed-Spraying Equipment

A SIMPLE, effective and economical means of applying a weed-destroying chemical across a 100-ft. right-of-way, on which the weeds had attained a thick and heavy growth, was developed during the last summer by the Peoria & Pekin Union. The equipment used consisted essentially of a tank car on which was mounted a long pipe extending over the right-of-way and fitted with a swivel movement so that it could be adjusted at any angle to the track. Means of adjusting the pipe in a vertical direction in order to compensate for differences in the relative elevations of the track and the ground was also provided.

Since the growth of weeds was exceptionally heavy, it was necessary to provide a spray capable of penetrating the thick foliage to the growths nearer the ground. This was accomplished by equipping the outer half of the long pipe with 15 small closely-spaced nozzles to secure the proper atomization of the weed killer. In addition, a relatively high pressure was employed to force the weed killer through the nozzles and the chemical was diluted with double the quantity of water ordinarily used for this purpose. Sodium arsenite was employed as the weed killer and was carried in the tank car, pressure being obtained from the train line. A

A View of the Apparatus in Operation

force of three men was sufficient to operate the equipment, which traveled at a rate of about eight miles an hour.

The outer portion of the right-of-way was sprayed during the first trip of the equipment over the track, the pipe then being adjusted to the inner position and that portion of the right-of-way adjacent to the track was sprayed on a second trip. Since this work was much in the nature of an experiment, no effort was made to equip the apparatus with means of applying the weed killer to both sides of the right-of-way simultaneously, although it was thought that this could easily have been accomplished. With this equipment, the cost of killing the weeds on a 100-ft. right-of-way was $175 a mile.

We are indebted to E. H. Thornberry, chief engineer of the Peoria & Pekin Union, for this information.

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of August			Eight Months Ending with August		
	1930	1929	Decrease 1930 under 1929, per cent	1930	1929	Decrease 1930 under 1929, per cent
Total operating revenues	$466,370,436	$587,322,413	20.6	$3,615,071,416	$4,213,688,666	14.2
Expenditures for maintenance of way and structures	**63,012,677**	**82,921,197**	**24.0**	**502,748,832**	**579,085,870**	**13.2**
Total operating expenses	327,204,296	396,204,945	17.4	2,732,292,415	3,035,101,917	10.0
Net railway operating income	95,603,922	141,758,499	32.6	555,302,117	828,394,791	33.0

Carrying Out

A Ten-Year Ballast Program

Grand Trunk Western rebuilds 334 miles of double-track line between Chicago and Port Huron, Mich.

Right—A Section of the Finished Track In Oval—Lifting the Track Ahead of the Surfacing Gang

DURING the last four years the Grand Trunk Western has been carrying on an extensive program of ballast renewal, the magnitude of which is indicated by the fact that during this period more than 150 miles of double-track line have already been brought up to the new standard. This program includes the restoration of the subgrade, the ditching of cuts, the reconstruction of highway crossings and the laying of 100-lb. rail to replace 90-lb. and 100-lb. rail in advance of the ballasting operation, wherever rail renewal is required.

Owing to the conditions which arose at the outset of the World War and continued for sometime after it closed, no reballasting had been done on the main line of this road between Chicago and Port Huron, Mich., 334 miles, for a number of years. As a result, when the program was approved late in 1925, all of the ballast on this line had been in service for periods ranging from 12 to 25 years.

The ballast in service at this time had consisted originally of bank-run gravel, the depth under the ties when installed varying from 6 in. to 12 in. In many places, particularly across the numerous swampy tracts which the railway traverses as it crosses the state of Michigan, the original application had been supplemented with locomotive cinders. The gravel contained considerable fine material and a small amount of silt. Attrition, as a result of tamping the ties over a long period of years, and the natural accretion of dirt in the ballast increased the content of fine material. This, in dry weather, combined with the cinders to cause a heavy cloud of dust during the passage of trains, resulting in considerable discomfort to passengers.

The traffic over this line is heavy, and at the time the program was adopted included 10 important passenger trains. This heavy traffic, the comparatively small amount of ballast under the ties, the fact that it was inferior ballast material when installed and its condition after long service, combined to make the maintenance of smooth riding track difficult, while the cost of maintenance was higher than it should be normally. In addition, the service life of the rail was shortened appreciably by the resulting track conditions. To improve track conditions and at the same time reduce the cost of maintenance, a comprehensive program of ballast renewal was adopted late in 1925, and work under this program was started at the beginning of the season of 1926.

As adopted, the program contemplated the complete renewal of the ballast from Chicago to Port Huron in ten years at the average rate of 33.5 miles of line a year. The riding qualities of the track have been greatly improved as the renewal progressed, while the maintenance costs of the reconditioned track are materially less than before. Furthermore, it was decided to increase the passenger service by the addition of a fast New York-Chicago passenger train and to shorten the schedules of other trains as well. These considerations led the management to revise the ballast program with a view to shortening the time of completion. Accordingly, additional forces were worked in 1929, sufficient approximately to double the amount of track completed in that year.

Surfacing began at Seventy-Fifth street, Chicago, early in April, 1926. This location was selected as the starting point because a track elevation project, which has since been completed, was imminent between Seventy-Fifth and Forty-Seventh streets. During that year 21 miles of double track were completed. This is the smallest mileage for any year since the program

was undertaken and is explained by the fact that most of the work was done in busy terminal territory where progress was necessarily slow. The following year, in 1927, a shortage of gravel which occurred at times, impeded progress, so that only 21½ miles of double track and 5 miles of single track were completed. The record for 1928 was increased to 37½ miles, and in 1929 a second gang was organized to work west from Port Huron, so that in this year 70 miles of double track were completed.

How the Work Is Handled

The surfacing east from Chicago has been done by a single gang of from 250 to 300 men, while a similar gang worked west from Port Huron in 1929. During the working hours, one track is turned over to the ballast gang, but is returned to operation under appropriate slow orders at night. In general, the section of track that is "killed" extends from one town to the next, in order to avoid the necessity of installing temporary crossovers. If the distance between permanent crossovers exceeds eight miles, however, temporary crossovers are installed about midway between stations. As soon as the first track between these stations is completed, the other is taken over, so that both tracks are completed before any work is done beyond the town next in advance of the outfit.

The organization of the gangs and the methods followed in the handling of the work have been perfected during the four years in which the reballasting program has been under way. Since the same methods are used by both gangs, a description of the work of the one out of Chicago will also apply to the operation out of Port Huron. This gang has averaged from 250 to 300 men from the start in 1926, except in 1927 when, owing to the difficulty in securing ballast, the gang was reduced to 200 men; at all other times it has been kept up to its normal strength. It is of considerable interest that, with few exceptions, the personnel has remained the same during the four years it has been in existence. There is quite a large apparent turnover monthly, but the men who leave keep drifting back, so that the number of men passing through the gang is surprisingly small.

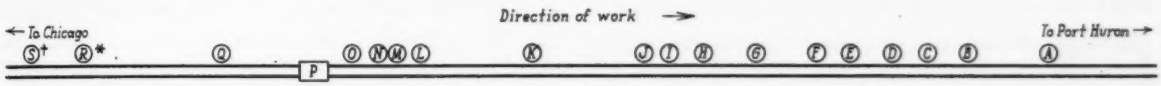
The first work on any section of track is to crib out for a minimum distance of one to two miles ahead of the actual surfacing. The maximum amount of stripping in advance depends on the tie condition, the amount the track is to be raised, the progress that is being made by the surfacing gang and the probable volume of ballast that will be received. An endeavor is made to synchronize this operation and that of tie renewals with the receipt of ballast, to minimize the amount of open track that is left overnight.

The old ballast is dug out from between ties, the outside ballast shoulder is broken down and the old ballast is applied on the shoulder of the subgrade by hand and with the aid of a Jordan spreader. If it appears that the amount of old ballast available is insufficient to make a complete restoration of the shoulder, the subgrade is widened and brought up to the foot of the old ballast with earth in advance of the cribbing. A locomotive crane equipped with an orange-peel bucket is used to dig out the old ballast from between tracks and place it on the shoulder of the subgrade. This latter operation is performed as the first track is reconditioned to avoid mixing the new ballast with the old and the consequent necessity of wasting some of it, if the center is stripped at the time the second track is reballasted.

Organization of the Gang

Immediately following the stripping gang, which consists of 52 men, one tie inspector marks the ties for removal. A gang of 18 men then place the new ties in position for insertion in the track, and two men test the gage, marking the places where it will be necessary to pull spikes from the sound ties in order to gage the track. Immediately behind the gagers, 18 men pull the spikes and two men remove the tie plates from the ties that are to be renewed.

The next gang, composed of 28 men, pulls the old ties out and inserts the new ones; three men insert tie plugs,



* Same as M † Men from various units assigned to dressing ballast

Sequence of Work and Assignment of Men to Various Units

Sequence	Kind of Work	No. of Men	Sequence	Kind of Work	No. of Men
A	Stripping gang	52	J	Reapplying tie plates	3
B	Inspecting ties	1	K	Spiking	60
C	Placing ties in position	18	L	Removing and reapplying rail anchors	4
D	Testing gage	2	M	Lining track	6
E	Pulling spikes	18	N	Loosening and tightening bolts	2
F	Removing tieplates	2	O	Unloading ballast	10
G	Renewing ties	28	P	Power jack	...
H	Inserting tie plugs	3	Q	Surfacing	60
I	Spacing ties	12	R	Final lining (same gang as M)	*
			S	Dressing ballast	†

after which 12 men with mauls space the ties, and three men reapply the tie plates. The following gang, which consists of 60 men in sets of three each, two spikers and one nipper, gages and spikes the track, and four men remove and reapply rail anchors. A gang of six men lines the track to stakes that have been set previously, and two men follow the lining gang to loosen and tighten bolts to provide for uniform expansion.

The ballast unloading gang consists of 10 men who are regularly assigned to this work, but are placed with either the stripping gang or the surfacing gang, as conditions warrant, when not engaged in unloading ballast. They also assist in the final operation of dressing the track when the surfacing and lining are completed.

The main surfacing gang consists normally of 50 men for tamping, one leveler, one spot-board man, six men spacing ties for the power track lifter and two men with the track-lifting machine. This assignment to the several units is based on a force of 282 men which was the number employed at the time the gang was visited. The number of men in the different units may vary, however, in accordance with the fluctuations in the size of the gang, the demands of the work, or the progress made on the different parts of the operation.

In addition to the track laborers, the gang organization includes one general foreman who is in charge of the entire operation and reports to the supervisor on whose territory he is working, five gang foremen, five assistant foremen, five motor car operators, five waterboys, one chief timekeeper, three assistant timekeepers, one commissary clerk, three cooks, three assistant cooks, nine waiters, two yard men whose duty it is to police the camp and do such odd jobs as arise, and one tool man.

Arrival of Ballast Is Scheduled

Information is received daily of the amount of ballast in transit and what can be expected for the next day. With this information in hand, the stripping of the track, the tie renewals and lining are carried forward as required. The movement of the ballast train is scheduled so that it can be unloaded upon arrival, thus avoiding delay to the train or the disorganization of the forces to make hasty preparations for it in case of early arrival. So far as this is possible, the stripping is carried only to the point where there will be no open track overnight.

Levels have been run and a new profile adopted well in advance of the work. Both grade and line stakes are provided and the track is raised in accordance with the stakes. The amount of lift depends in large measure upon the prior condition of the surface, but is held to a minimum of six inches. The first lift is made to within about two inches of the final grade and this is followed

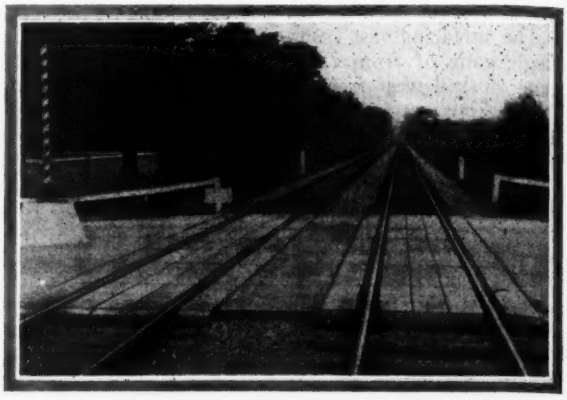
All Curves Are Lined and Spiraled

by a second lift after the passage of a sufficient number of trains to consolidate the new ballast.

All curves are lined and spiraled in accordance with the Bartlett method of string lining, as explained in a series of articles which appeared in *Railway Engineering and Maintenance* during 1928. Following the final lift, the track is again lined and the gravel for dressing the track is unloaded. In the dressing operation a heavy line is stretched taut on the shoulder of the subgrade at the proper distance from the rail, and the ballast is dragged down with shovels to form a sharply defined toe line. The ballast shoulder is then shaped up and any surplus ballast is placed in the space between the tracks, where it can be used to raise the adjacent track or disposed of later without disturbing the outside shoulder.

Method of Distributing Ballast

The ballast is received in center-dump hopper-bottom coal cars and as it is unloaded it is plowed off the track with ties. Ordinarily it is very difficult to control the unloading from cars of this type, particularly if there is an abrupt change in the amount of ballast required at any point, or if a small amount is needed over a considerable distance, as in distributing for dressing the track. In order to overcome this difficulty a special adjustable clamp has been devised to use when the unloading is light, which is applied to the hoppers before the doors are opened. By means of this device excellent control of the flow of ballast has been obtained. Occasionally a car will get out of control, however, in which case the locomotive crane picks up the excess material and loads it into a special car which has slots cut in both sides of the hoppers. By means of sliding gates operated by levers this ballast can be distributed to fill out any weak places which may occur. Except for six miles between Olivers, Mich., and Crumstown, where crushed stone was used, the new ballast is washed gravel obtained from commercial pits along the line of the railway.



Concrete Slabs Replace Wood Plank at Crossings

The ballast application averages about 3,100 cu. yd. to the track mile. The average progress for the season of 1929 was 2,500 ft., or approximately one-half mile of completed track a day. This average, however, is based on the total number of working days during the period covered by the season's work. When a deduction is made for the time lost on account of weather and other causes beyond control, the average progress for the time actually worked becomes slightly more than 3,000 ft. a day. The maximum amount of work accomplished in any day was 9,750 ft. of track skeletonized, tied and given the first lift.

The ties used for renewal are practically all creosoted, the small remainder being untreated white oak. As might be expected with this type of reconstruction, the renewals are fairly liberal, although no tie that may be expected to last two years is removed, except at highway crossings, where all of the old ties are replaced with creosoted ties. Where the joint ties are rail cut or otherwise are not in good condition they are removed and replaced with sound ties, even if it is believed that they have more than two years service life remaining.

Reconstructing Highway Crossings

One of the important features of the program is the reconstruction of all highway crossings. The new elevation of the track makes it necessary to raise the approaches at every crossing. On unimproved roads this is done with gravel or limestone screenings. On paved roads and streets the pavement is removed for a sufficient distance to permit the construction of easy approaches and the street is then repaved. As mentioned,

all of the old ties are replaced with new creosoted ties through the limits of the crossing. The joints are welded so as to give a minimum of one rail length of continuous rail on each side of the crossing and at all but those of light traffic the wooden plank is replaced with concrete slabs or with steel or cast iron sections. The concrete slabs have been used for four years, but the first metal crossings were installed in 1929.

The camp equipment consists of 72 cars as follows: 42 bunk cars, five cars for the foremen, assistant foremen and timekeepers, three kitchen cars, ten dining cars, four commissary cars, three helpers cars for the cooks and waiters, two tool cars, two supply cars fitted with ice boxes and one ice car, handled by the local freight train, in which a supply of ice is shipped two to three times a week. In addition, three locomotive tanks are assigned to supply coal and water. These tanks are handled by the work train when it is necessary to replenish the supply of coal or water. The water is piped from the tanks to one of the commissary cars, from which it is distributed to the other cars in the outfit by means of a small capacity gasoline engine.

The Globe Contracting Company which specializes in the maintenance of labor camps furnishes all provisions and feeds the men for $1.10 a day. This company also furnishes all of the equipment required for housing the outfit, except mattresses and steel bunks, and looks after the cleanliness and sanitation of the cars. It also provides the cooks and waiters, but these men are carried on the gang pay-rolls. The railway furnishes the ice.

The camp is made as nearly permanent as possible with work of this character. When necessary to move ahead, it is moved to a point approximately 12 miles in advance, so that the maximum distance over which the men must be taken to reach the work is six miles, and the camp is then allowed to remain undisturbed for a period of six or seven weeks.

Results Justify Expenditure

One of the noticeable results of the improvement is the better riding quality of the track and another is the almost complete elimination of the dust which was so objectionable on the old ballast. From an economic standpoint, however, ample justification for the expenditure is provided by the reduced cost of maintenance. Following the completion of the work, it has been found practicable to reduce the section gangs from their normal complement of six or eight men to two men. Experience has shown that for at least the first two years, the work of the section gangs consists largely of policing and a moderate amount of surfacing and lining to keep the track in smooth riding condition.

The restoration of banks and of the roadbed through cuts, resulting in better roadbed drainage, reduces the amount of labor in maintenance, less work is required around frogs and switches, while the improved highway crossing construction has the same effect.

While the increased service life of the ties and rail is not as tangible at this time as the saving in labor, there is ample evidence that there will be a definite increase in the life of both. Better drainage, the smaller amount of tamping required to keep the track in surface and the decreased vertical movement of the ties as a result of the better foundation, are all combining to prolong the service life of these members of the track structure so that there should be a measurable reduction in the future in the cost of tie renewals.

Likewise, the effect of the improved foundation for the ties and the elimination of pumping joints can already be noticed in the performance of the rail. While this effect is not so apparent on the rail that has been in the track for several years and is already battered to some extent, the new rail is showing less tendency to batter than when laid on the old ballast. Furthermore, because rail is usually removed from the track because of battered joints rather than because of wear, it is thought that much of the old rail can have its service life greatly extended by reconditioning the joints.

The entire ballasting operation is being carried out under the general direction of F. A. Tranzow, general roadmaster. The track supervisor on whose district the gang is located is in direct charge of the work. F. M. Corbett, general foreman, is in charge of the gang. A. E. Haywood, assistant engineer, prepares the profiles and is responsible for all other engineering work that is required and arranges with the local highway and municipal authorities for the work that is necessary at street and highway crossings.

Do You Plan Your Tie Renewals Well?

TIE renewals are not only the most expensive part of the track maintenance program, but they consume the greatest amount of time and, since this work is first on the program, the manner in which it is handled has an important effect on the rest of the year's work. If tie renewals are commenced at one end of the section, pushed through out-of-face and completed on time, a certain momentum is gained and the section forces are in a good position to complete the other items on the program. If a poor start is made on tie renewals and they are not finished on time, or perhaps not at all, the work on the other items of the program is retarded throughout the year.

The renewal of ties is important because it affects the general condition of the track, as a first-class job of renewing ties will greatly improve the track by making it smoother, safer and stronger. On the other hand, a poor job of tie renewals will not result in good-riding track and the general condition will be poor until corrected.

One of the important features of tie-renewal work is in being prepared for the job on time, and all the other items on the season's program should be out of the way to avoid undue interference. Bolts should be tightened and the track given a smoothing up just before tie renewal work is commenced, so that all the time possible may be devoted to placing ties.

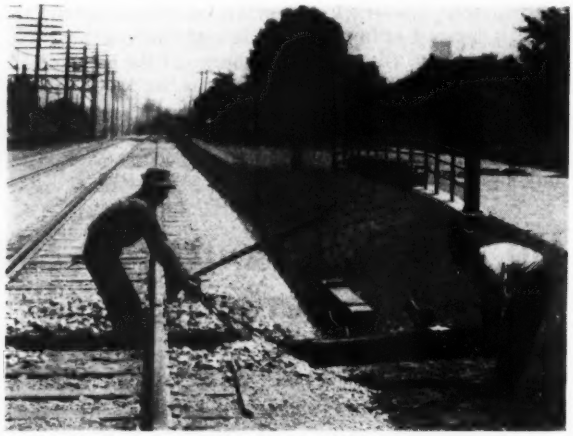
One of the first things the foreman should do in connection with tie renewals is to check up on the ties that are to be taken out on each mile, and then to see that he has plenty of new ties for renewals. If it is found that an insufficient supply of ties is on hand, the matter should be taken up with the roadmaster. Ties sufficient for several days' work should be distributed so that this job will not have to be done every morning and, in doing so, the line end should be placed correctly in order that it will be unnecessary to turn the tie end for end when inserting it in the track. Other material, such as tie plates, spikes and date nails, should be taken out each day so it will not become scattered.

Every move that can be made to speed up the tie renewals should and must be made. It is not good practice to tear up the track while placing ties, nor

*Reproduced from an article in the Kansas City Southern Magazine which was written from several papers presented before the Kansas City Southern Maintenance of Way Association at various meetings.

should too much repair work be done at this time. However, while inserting ties, other incidental work should be promoted as far as possible, such as stacking the old ties and piling them on some shrub or stump on the right of way, so that when they are burned these objectional growths will be destroyed also.

All tools should be in good condition and particular attention should be given to the tie tongs to make



Dull Tie Tongs May Cause Personal Injury

sure that they are properly sharpened, as dull tongs are apt to slip and cause personal injury. The foreman should select his men carefully—men who he knows will work well together—and should keep them together throughout the tie renewal work. It is the foreman's duty to be on the job every possible minute and to see that the work is carried out as quickly as is consistent with a thorough job.

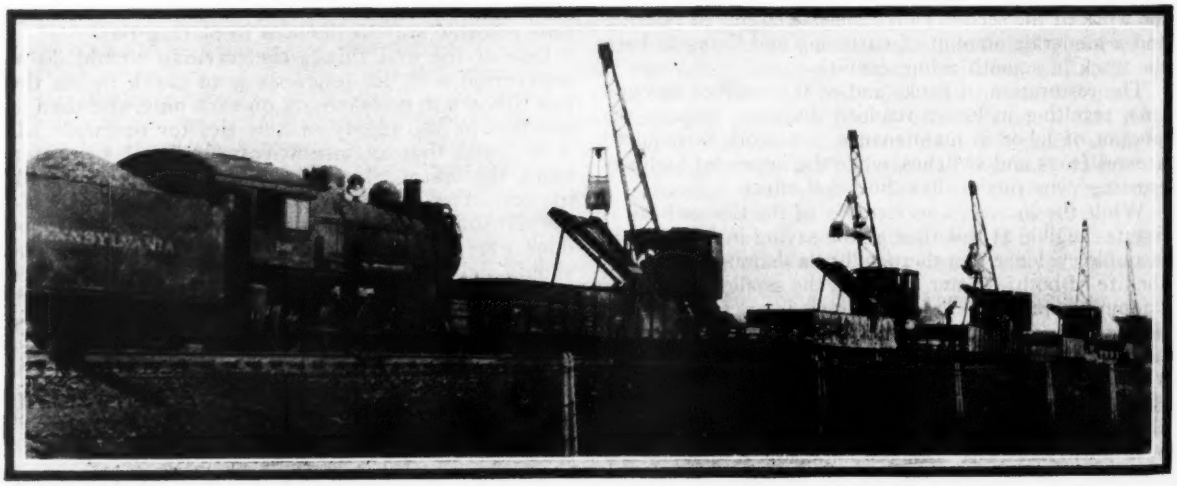
It is important that a correct record of tie renewals be kept and, when starting the day's work, the foreman should check the dates on all ties to be renewed, for, if he waits until they have been removed, he will be unable to get a correct check, as some of them will be damaged in such a way as to prevent this. Care should be exercised to see that the ballast section is not disturbed unnecessarily when the ties are being removed. If two adjoining ties are removed, only one space should be dug out and, also, only one hole should be dug through the ballast shoulder for the tie renewals. These precautions will save time in dressing up the ballast section.

When placing new ties, the hole should not be dug any deeper than is necessary and ties should be well tamped from end to end up against the rail. The rail should then be nipped up and plates applied. This is the most important part of a good job, for if the new ties are not given some advantage over the old ties, it will not be long until they are swinging, especially in wet weather, and if two or three ties have been renewed at one place, this condition will cause surface-bent rail.

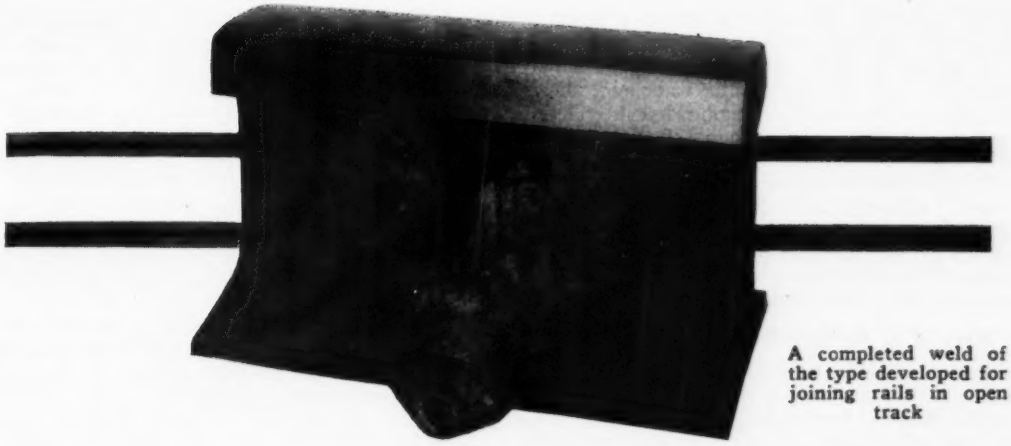
The track should be spiked, gaged and dressed up as the work progresses if the day's work covers a long stretch. But if it covers only a short length of track—say three or four poles—it is best to do only the spiking necessary for safety and to finish the other work at the end of the day. The surplus ballast should be distributed each way in order than no humps will be left in the ballast shoulder, and joint ties that have been shifted should be squared up, as in an oblique position they will affect gage and line adversely and will have an objectional appearance. Only good spikes should be used when spiking new ties and the old but serviceable spikes should be used in old ties when spikes are missing. Ties that are deeply rail cut, but not sufficiently so to cause their removal, should be adzed and an application of creosote made. Spikes should be headed down in old ties and date nails applied to the new ties when the work is completed.

At the close of each day's work, all old ties should be stacked neatly in piles large enough to burn on the side of the track opposite the telegraph poles, and about 20 ft. from and parallel with the track, where they should be left for inspection. Old ties should never be piled near a culvert or drain pipe and all scrap should be picked up and removed to the tool house each day.

After the regular tie renewal program starts, it is best that the roadmaster watch the track condiions and keep the foremen posted of any defects that must be corrected at once. This will enable the foremen to stay on the job, as they do not run over their sections every day or so just to inspect the track unless heavy rains or storms have occurred.



A Battery of Cranes in Ballast Cleaning Service on the Pennsylvania



A completed weld of the type developed for joining rails in open track

Thermit Weld Rail Joints in Main Line Tracks

Observations of practices and installations here and in Germany

By J. H. DEPPELER
Chief Engineer, Metal & Thermit Corporation, New York

THE THERMIT process has been developed in America primarily to take advantage of the great purity of the steel produced by the Thermit reaction, with the result that the welds are rarely unsound and have physical qualities comparable with ultra-refined electric furnace steels; strong, ductile and shock and fatigue resisting. The natural consequence is, therefore, that while Thermit welding has made rapid strides in replacing mechanical joints in the tracks of street railways, its most spectacular application is found in the steel mill, the railway shop and in the shipyard. In Germany, on the other hand, by far the most important use of Thermit welding is found in welding rail in both open and embedded tracks. That our experience in the elimination of rail joints by Thermit welding is of no little importance, however, is evidenced by the fact that, at the present time, Thermit welding of rail joints is practically standard practice on 85 per cent of the street railways of the country. The work of this nature was naturally confined to embedded track, at first, where there was the least concern about the effects of long rail as regards rail failures, expansion and contraction and buckling, but ,at the present time, Thermit welding is being extended to the joining of rails in open track.

European and American Practices Differ

Owing to the variation in the conditions existing here and in Germany the development of Thermit welding, particularly as regards rail joints, has been largely along different lines; the Germans specializing in what is termed a "pressure weld," while, until lately, we have given the most attention to what is called the "insert weld." The use of the latter weld in this country has expanded rapidly until, at the present time, approximately 100,000 insert-welded rail joints are being installed each year.

In making this type of welded joint, the rail ends are separated about half an inch and a steel insert is placed between the rail heads in such a way as to present a continuous running surface on the rail. After the insert has been put in place, the rail ends are surrounded by a two-part sand mold, which has been rammed previously on metal patterns and, which, therefore, can be applied easily and clamped into position. This mold, which is of special design, has the usual preheating gate at the bottom and risers at the top, and provides for the application of reinforcing metal around the base and web of the rail, and also on the outside of the head.

When the mold has been clamped in place, the rail ends are heated by a special portable preheater, which, at the same time, bakes the green sand mold. This operation requires about twenty minutes. When the rail ends have been brought to a red heat and the mold is thoroughly dried, the heater is withdrawn, the preheating gate is plugged, and a crucible, filled with Thermit, is mounted in position directly over the pouring gate of the mold. The Thermit is then ignited and after about twenty seconds, when the reaction is complete, the crucible is tapped from the bottom and the highly superheated molten steel and slag are allowed to flow through the pouring gate of the mold into the space between and around the rail ends. In its highly superheated state, the Thermit steel fuses with the rail ends and unites them.

The insert weld as developed for application to street

railways has strength and wearing qualities equal to the rail itself; it has 100 per cent electrical conductivity, and it can be installed at a rapid rate. Furthermore, it requires no moving of the rails and, therefore, the rails can be completely embedded in concrete so long as an opening is left around the rails at the joint until after the weld is made. This same weld lends itself to installation under traffic, a recent development, which, although a little more expensive, is, nevertheless, quite practical. In making the welds, the co-ordination of the various operations on consecutive joints makes it possible for a small group of men to complete from 30 to 40 joints a day.

Method of Making Pressure Welds

In Germany a slightly different type of weld has been developed in which the bases and webs of the rails are fusion welded and the rail heads pressure welded. This joint has the advantage of a little greater resistance to negative bending moments and, theoretically at least, is slightly more economical in the use of the Thermit as the heat of both the Thermit steel and the slag is used.

For a number of reasons the insert weld did not lend itself as well to the welding of open track joints as did the pressure weld and, therefore, the most recent progress in the welding of joints in open track in this country has been in the adapting of the pressure weld to the conditions existing in this country. In the pressure weld the heads of abutting rails are machined with a hand-operated shaper, and ¼ in. of metal is cut away from the webs and bases of the rails, providing a gap of ½ in. between them to facilitate the fusion welding.

When actually making the weld, the machined faces of the rail heads are held together firmly by clamps, and the Thermit steel is allowed to flow around the rail ends much the same as with the insert weld. A two-part mold is used in making the weld, and is filled with Thermit steel up to a point about one-half inch under the bottom of the rail heads. While fusion welding is taking place between the webs and bases of the rails, the superheated alumina formed in the Thermit reaction surrounds the white hot rail heads, which are pressure-welded together. This pressure welding is accomplished by drawing up on the rail clamps sufficiently to upset the metal of the rail heads while at a welding heat. After the weld has cooled, the molds are removed and the gage side and running surface of the rail at the weld are filed or machined off to remove the slight upset formed in the process of making the weld.

The combination fusion and pressure rail weld developed for use on steam railways is not necessarily an improvement on the insert method of welding, but is designed to meet the more exacting conditions of the flexible roadbed of steam railway construction. This type of rail weld exhibits the same properties of strength and wear resistance as the rail itself, and so far as can be judged from laboratory tests, and from observations of joints in service in this country for over a year, and of joints in service abroad for a number of years, it appears that this type of joint should last as long as the rail itself.

In Germany, the fusion-pressure method of welding joints in open track has been carried on experimentally since 1924, and, during the last three or four years, has been used extensively in main line track. It is true that conditions abroad are somewhat different from those found here. For example, the rails are usually lighter in weight and of softer steel, and the equipment and corresponding wheel loads are likewise lighter. Nevertheless, it is interesting to note that an extensive examination last year of rail welds in the tracks of the German railways did not reveal a single instance where there was any evidence of greater wear at a welded joint than in the adjoining rails.

Pouring One of the Thermit Joints

Machining the Abutting Rail Ends With a Hand-Operated Shaper. Note Clamp in Place for Holding Rails Together

A Completed Pressure Weld Before Grinding. Molding Sand Still Adheres Hiding Lower Portion of Weld

First Open-Track Welding in Germany

The first open track welding experiments in Germany were carried out in the Nürnberg region, on a much-used lead track to a freight yard. From 16 to 26 freight trains enter this yard each day. The total length of track in the experiment was about 4,000 ft., which was welded into lengths varying from 200 to 360 ft. with carefully adjusted and positioned expansion joints between them. Naturally, construction was carried out carefully; the expansion joints were set for the temperature at the time, and careful calculations were made of the tensile and compression stresses in the rail under all possible conditions, and of the shearing stresses on the expansion joint bolts. There was nothing unusual about the construction otherwise. Some screw spikes were used and some ordinary ones. Ordinary ties and ballast were also used. A few anti-creepers were installed near the middle of each welded stretch. The results were excellent. There were no breaks, and the smoothness and quietness of operation were very striking.

When I inspected this track in May, 1928, it was in excellent condition except for the expansion joints.

These had spalled off on the sides and sliding contact faces, and had long since stopped functioning as expansion joints. So here in reality we had 4,000 ft. of track with ordinary bolted joints at the ends, straight track and curves, with no broken rails and no spreading gage, although the normal temperature variation was from 4 deg. to 104 deg. F. Subsequently, the Nürnberg classification yard was welded up solidly and the effect of the cars sliding noiselessly into the yard was very noticeable.

Near here also, another experimental stretch was finished in 1927. This was a tangent, 1,000 ft. long, with ordinary bolted joints at the ends. This track was welded when the temperature was 40 deg. F., the bolted joints being left open about 3/8 in. When I was there in May, 1928, the temperature was 80 deg. F. and the bolted joints at the end of the 1,000 ft. were still 1/4 in. open. In other words, the welded track did not behave as a steel bar free to move, which, with a 40 deg. change in temperature, would lengthen about 3 in., but instead, lengthened only about 1/4 in., and half of this at each end.

Main Line Welding Now Common Practice in Germany

Shortly after these experiments, the engineers of the State Railways decided to weld the rails on the steel railroad bridges because here the expansion of the bridge members and of the rail would be the same and, therefore, there could be no fear of buckling or of rail breakage. Many such installations have since been made, but I had time to inspect only the bridge across the Rhine at Cologne. The entire absence of noise as fast passenger trains glided over this bridge was very noticeable.

In 1928, the German State railways embarked on a regular program of welding on their main line tracks and started the elimination of half of their mechanical joints by converting 50-ft. rail lengths into 100-ft. lengths. Their initial order called for 60,000 welds, but during 1929 between 75,000 and 100,000 welds were made in main line tracks in a program eliminating every second joint. This work was under way while I was there. The new rails were welded on loose ties along the side of the right-of-way, and were lifted over and spiked in place between trains. It is expected that the rail mills will shortly be delivering 100-ft. rails, and then, it is their intention to weld every second joint of these, making lengths of 200 ft.

Although the bulged fish plate is no longer used as a precaution against welded joint breakage, nevertheless, they do use a double tie at the joint. The German practice of placing joints opposite each other instead of staggering them, as is done in this country, allows this double tie to serve two welded joints.

Welded Joints Prove Effective in Tunnel

Another general application which the German engineer readily agreed to was the welding of the rail in tunnels. Here the bolted joints and their maintenance present a more serious problem than anywhere else. A notable example is the tunnel on the Frankfürt main line track at Schlüchtern. This tunnel is about 12,000 ft. long, and the cold damp air within it, combined with the poor ventilation and the gases from locomotives, rapidly corroded the splice bars and bolts at the joints, and, to a considerable extent, the tie plates and spikes. This tunnel track had to be entirely rebuilt every four or five years and required almost constant maintenance.

The Thermit welding of this track was started late in 1924, and at first the joints were completely eliminated in the 4,000 ft. section in the middle of the tunnel. The rest of the rail was welded at the side of the track in 300-ft. lengths and put in place between trains. These shorter units were found more convenient to handle and there was less danger of disrupting train schedules. With practically all the splice bar and bolt corrosion troubles eliminated, they solved the tie plate problem by using fiber plates, and instead of the lighter spikes, they used heavy-headed screw spikes. The few bolted joints remaining in this tunnel are easily maintained, and, although insufficient time has elapsed as yet to determine the life of this tunnel track definitely, it has been, without doubt, doubled, and probably quadrupled.

Tests in the United States

Until the development of the pressure weld in this country, we did little of this type of Thermit welding, and, in fact, there had been relatively little Thermit welding of any kind in open tracks. As the result of recent developments in pressure welding, however, it is expected that this method of making rail joints will be more widely adopted.

The only rail welds of the pressure type which have been made in this country include about one hundred in the DeWitt freight classification yard of the New York Central at East Syracuse, N. Y. These welded joints, which were installed toward the end of 1928, were used in connection with the car retarder installation in the yard, and overcame the interference to the operation of the car retarder, which would have been occasioned by the use of the ordinary type of rail joint. On an inspection of these welded joints, more than a year after their installation, during which time many thousand loaded freight cars had passed over them, the joints were in such good condition that they could be found only by careful search for the Thermit collars on the bases of the rails.

The engineer maintenance of way is bound to be slow to adopt a method which on first thought would seem to introduce enormous strains and might result in broken rails in winter and "sun kinks" in summer. An elaborate mathematical calculation has been worked out to prove that where the points were welded with due regard to the temperature at the time of welding, the maximum temperature variation between summer and winter would cause no trouble, but such a calculation must be supported by experiment and, so far, few American engineers have been willing to make these more elaborate experiments.

Thermit Joints Proved Effective Through the Car Retarder Installation in This Yard

The German engineer feared the consequences less because his rails were lighter and very much softer and more ductile; their maximum carbon content was

only about 0.40 per cent as compared with our 0.80 and 0.90 per cent. The experience in Germany has definitely indicated that the resistance of the weight of the rail, the friction on the tie plates, etc., cause temperature changes to have no greater effect than to change the compression strains in the rail and that even in a thousand feet of rail without joints, ordinary bolted joints may be used at the end and that the opening and closing of these bolted joints are only about the same as for a single rail length.

Rail Expansion Is Contrary to Accepted Theory

Near Berlin there is considerable freight track welded in 1,000 ft. lengths, and at one place, parallel with the welded running rail, there is a welded rail mounted on rollers. This latter rail obeys the law of expansion, so to speak, while the rail in the track itself does not. The general observation is that in a given length of welded rail, the 40 ft. on each end appears to be virtually free to move with changes in the temperature, while any length of rail between these ends stays practically stationary. So from the standpoint of expansion and contraction, an 80-ft. rail behaves no differently than a 1,000 ft. rail, and probably one of 2,000-ft., or even an endless rail would be perfectly feasible if it were not for the difficulty of repairing a broken rail.

The American engineers' experience has led him to believe that this cannot be true because even his relatively short rail lengths have given him trouble, the joints closing up completely in extremely hot weather and the track buckling. We believe, however, that this apparent discrepancy between the supposed facts here and abroad can be easily explained. The standard construction abroad includes a tie plate with a shoulder on each side of the base of the rail, whereas in the usual construction in this country the tie plates have only a single shoulder. It is our present belief that this apparently slight difference is really of major importance and we believe that the few experimental installations already made in this country support this idea.

A double-shoulder tie plate does not, of course, fit the rail base closely, but the slightest tendency for the rail to warp brings the rail base into contact with the diagonally opposite shoulders of the tie plates and this friction, added to the weight of the rail and the friction of the spikes, does apparently prevent the rail from moving during temperature changes.

American Experience with Long Rails

There are experimental installations in this country which seem to bear out these apparent facts. One of these is not a welded track at all, but is the installation of about five miles of the main line track of the Lehigh Valley near Towanda, Pa., in which 66-ft. rails of 136-lb. L.V. section were used instead of the standard length of 33-ft. rails. This installation was described in *Railway Engineering and Maintenance*, May, 1930, page 202, as having been made March 23, 1929, and in this description the prior German practice is referred to in the following quoted paragraph:

"It has been common practice on the German State Railways for some time to use rails 30 meters, or 98.42 ft. in length, and in many cases these long rails were welded together. A conference with Dr. Buckholtz of the German State Railways indicated that no trouble was being experienced, insofar as expansion was concerned, even though very limited openings were allowed at the joints."

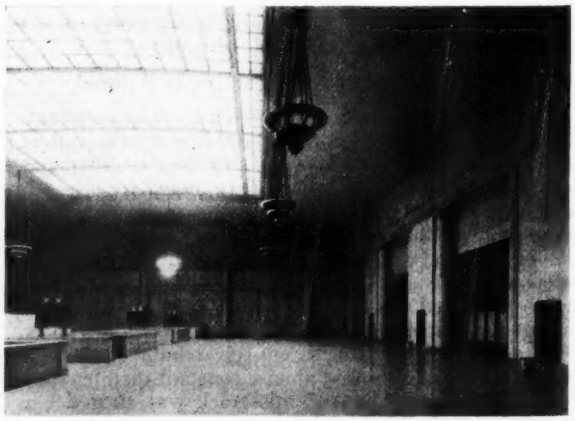
The article refers also to studies that had been made in America wherein long stretches of 33-ft. rails were found tight together and so firmly fastened that expansion was impossible. In this Lehigh Valley installation made with 66-ft. rails and six-hole, 38-in. angle bars and the rails laid on double-shoulder tie plates, the temperature at the time of laying was between 35 deg. and 40 deg. F. and the rails were laid practically tight. At the time the article was written the rails had passed through the extremely hot weather of the summer of 1929 and the subsequent winter and during this hot weather the entire five miles was raised and surfaced without any tendency for the track to swing out of line or become "kinky." Since this installation was made, the article says, the temperature has ranged from 35 deg. to 100 deg. F. and that at no time has there been evidence of expansion or contraction.

A Street Installation

There are a number of other installations of Thermit welded rail joints in open track in the United States, and while these are on electric railways and involve insert welds, they serve to give further proof that rail expansion will not be a troublesome factor in the use of long unbroken rail lengths. One of these installations of special interest is on an electric railway in Chicago, on Vincennes road, between 90th and 95th streets. In this installation the rail is Illinois Steel section No. 10025, in 60-ft. lengths, laid on sawn ties, spaced 24 in. apart in crushed stone ballast. Single-shoulder tie plates are used with screw spikes and rail clips. The rail is single spiked in diagonally opposite holes in the tie plates, with the exception that the rail is double spiked on the inside only at every eighth tie, and also on the inside at the tie immediately at each side of the welded joints.

The longest length of unbroken track in this installation consists of 20 rails, or 1,200 ft., and the shortest length consists of 14 rails, or 840 ft. The expansion joints provided at the ends of the long rail lengths are formed by angle bars of the continuous type, in which two bolts are used through the receiving end and none in the run-off end. When laid originally in the fall of 1928, ½ in. openings were provided at the expansion joints. These openings have varied in size since, and, at the time of an inspection early in 1929, when the temperature was 42 deg., they varied only from ⅞ in. to 1⅜ in.

It would, of course, be unwise to advocate immediately the promiscuous welding of joints in main line tracks in this country, but so much can be done in freight yards, in terminals, in tunnels, and on bridges, that it certainly should not be long before valuable knowledge will be available, and the merits of Thermit-welded rail joints proved, if such merit exists.



Concourse of the Cleveland Union Terminal

Pier in Chicago & Alton bridge over Auxvasse Creek, near Auxvasse, Mo., in service 58 years

Bridge Men Meet at Louisville

Consider crib walls, masonry failures, camp cars, the welding of structural steel, power tools, modernization of station buildings, etc.

APPROXIMATELY 150 members of the American Railway Bridge and Building Association gathered at the Brown hotel, Louisville, Ky., on October 21-23 for the 40th annual convention of this organization. While the attendance was somewhat below that of recent years, the meeting was characterized by unusually active discussion.

Differing somewhat from the programs of recent years in which committee reports were interspersed with addresses on topics of special interest to the members, the time of the convention this year was devoted almost entirely to the consideration of the reports of eight committees. These reports dealt with such timely topics as the relative advantages and costs of precast concrete crib walls and monolithic walls; masonry failures—their causes and remedies; the programming of bridge, building and water-service work; the use of power tools and equipment in bridge and building work; camp cars and their equipment for bridge and building crews; the inspection and maintenance of water tanks and appurtenances; the modernizing of station buildings; and the maintenance of turntable and drawbridge machinery. These reports were supplemented by a session on Tuesday evening which was devoted to the consideration of welding, at which H. M. Priest, assistant engineer, American Bridge Company, New York, spoke on the reliability of commercial welding of structural steel and W. R. Roof, bridge engineer of the Chicago Great Western, Chicago, described the manner in which that road's bridge over the Des Moines river was strengthened by this process.

All sessions of the convention were presided over by J. S. Huntoon, president of the association and assistant bridge engineer of the Michigan Central, assisted by C. A. Lichty, secretary-treasurer. Mr. Lichty's report showed the membership of the association to be 714.

Abstracts of various reports and papers presented at the convention appear on the following pages, except

the report on masonry failures and the two papers on the welding of structural steel which will be published in later issues.

Officers Elect

At the closing session of the convention on Thursday morning, the following officers were elected for the ensuing year: President, C. S. Heritage, bridge engineer, K. C. S., Kansas City, Mo.; first vice-president, A. I. Gauthier, assistant division engineer, B. & M., Concord, N. H.; second vice-president, H. I. Benjamin, assistant engineer bridges, S. P., San Francisco, Cal.; third vice-president, W. T. Krausch, engineer buildings, C. B. & Q., Chicago; fourth vice-president, T. H. Strate, engineer track elevation, C. M. St. P. & P., Chicago; directors: A. B. Scowden, general bridge inspector, B. & O., Cincinnati, Ohio; W. A. Batey, general bridge inspector, U. P., Omaha, Neb.; and L. C. Smith, supervisor bridges and buildings, I. H. B., Calumet City, Ill. C. A. Lichty, inspector, purchasing department, C. & N. W., Chicago, was re-elected secretary-treasurer for the 21st consecutive year. Accepting the recommendation of its officers-elect, the association voted to hold its next annual convention in Toronto, Ont., on October 20-22, 1931.

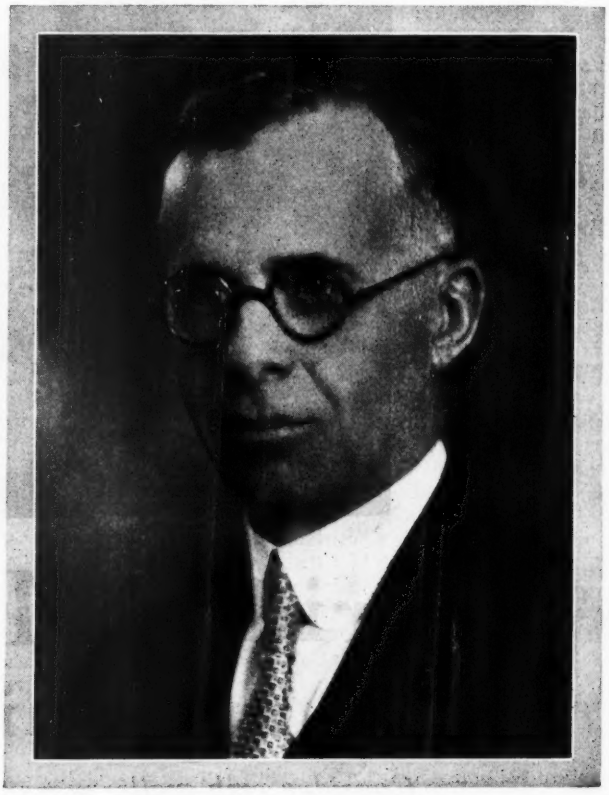
At this session the following subjects were selected for consideration and report by committees at the next convention:

1. Means of interesting bridge and building employees in safety measures.
2. The relative economy of the various culvert materials—cast iron, concrete and corrugated-iron pipe and treated wood.
3. The relative advantages of separate as compared with combined gangs for bridge and building work. Under what conditions are each advisable?
4. The maintenance of ballast-deck trestles and economical methods for replacing individual piles, caps or stringers.
5. The relative merits of inside metal and outside wooden guard rails. Are both necessary? Can a satisfactory method be developed for spacing ties and fastening the wooden floor to the structure, which will make the wooden guard rail unnecessary? If so, is there any other advantage in eliminating the wooden guard rail?
6. The possibility of standardizing materials used in railway water service.
7. The comparative cost, durability and protective value of brush and spray painting.
8. High-early-strength concrete—its place in bridge and building work.

Following the adjournment the members made an inspection of grade separation work now under way in Louisville and also on the recently constructed bridges of the Pennsylvania, the Kentucky & Indiana Terminal and the Big Four across the Ohio river on a special train provided by the Terminal company.

J. S. Huntoon
President

Mr. Huntoon was elected president of the Bridge and Building Association last year after 14 years of active participation in its work. During that time he served on seven different committees, having been the chairman of two of them, the Committee on Labor-Saving Devices of 1922, and the Committee on Tool Equipment in Bridge, Building and Water Service Work of 1923. He was elected a director in 1923 and began his advancement to the presidency with his election as fourth vice-president in 1925. Mr. Huntoon gained his broad practical knowledge of railway bridges with the Michigan Central, with which road he has held the position of assistant bridge engineer since 1918.



W. R. Cole Addresses Convention

Shortly after the convention was called to order on Tuesday morning W. R. Cole, president of the Louisville & Nashville, addressed the group on the present railway situation. After welcoming the visitors to Louisville, he said that the railways are now facing problems of a more varied character than ever before. "The Transportation act of 1920 was heralded," he said, "as marking the beginning of a new day. For the first time it was recognized that the railways are entitled to a fair return and the Interstate Commerce Commission was instructed to so regulate rates that the roads would be enabled to earn this return, most of the legislation enacted prior to this time being designed to curb the activities of the roads in one way or another."

Mr. Cole then pointed out that the avowed interest of Congress in this direction has not been achieved in that the roads have not earned this rate in any year since the law was enacted. While not placing on the

commission the full blame for the present condition of the railways, he expressed the opinion that in ordering reductions in rates the commission has not given sufficient attention to the conditions that are now confronting the railways.

"Valuation is being given too much consideration in rate making today," he said, "ignoring the fact that other influences are becoming of increasing importance, as, for instance, the competition of other agencies." He deprecated the use of the cost of reproduction basis for valuation and also the 1914 prices, forecasting that such action will only result in endless litigation.

Mr. Cole then discussed the various forms of subsidized competition which now confront the railways, especially on the highways and waterways. "The automobile represents an evolution in transportation," he said, "and the railways have no right to complain about its competition so long as it is fair. Today, however, the highways are built at public expense for the use of this new competitor. Even more unfair is the competition on the waterways; the government is not only providing the channel at public expense, but is itself engaged in transportation on these waterways, with the deficit paid out of public funds. The present barge rates are possible," Mr. Cole said, "only by reason of the backing of the United States Treasury." He urged that these lines be placed on the same basis as to methods of accounting, taxes, etc., as the railways, in order that the merits of waterway transportation may be determined with fairness.

Inspection and Maintenance of Water Tanks aud Their Appurtenances

COMMITTEE REPORT

IT IS estimated that there are 27,000 water tanks in service on American railroads. Wood, steel and concrete are used in the construction of these tanks and towers, the majority of the tanks in use today being of wood, although steel has come into widespread favor within recent years and the number of steel tanks in service is constantly increasing. Concrete tanks are used to only a limited extent. Modern locomotive tenders have capacities up to 23,000 gal. and tanks of 100,000 gal. capacity are now standard on most railroads, while 200,000-gal. tanks are also used and tanks of 500,000 gal. capacity are not unusual.

E. H. Brown
Chairman

Inspection of Steel and Wood Tanks

The cost of the maintenance and repair of tanks and their appurtenance depends upon: (1) the design, materials and methods used in the original construction; (2) the frequency and character of the inspections and the attention given to the resulting suggestions and recommendations; (3) the entire performance and the length of life of tanks and their appurtenances depend on the amount of interest taken by superior officers in their maintenance and operation. It is their duty to see that they are properly operated and maintained.

On account of differences in the organization and titles of bridge and building and water service departments of various railroads, no definite recommendations are made as to the person who should be delegated to make inspections. However, in general these should be about as follows:

1. Pumpers or other employees whose duty it is to look after the tank are in a position to report to their immediate superior officers any noticeable defects in the tank or appurtenances, and they should be instructed to do so.

2. Pump repairers or water-service foremen, on their periodic tours of inspection, should take care of "running repairs" and report to their immediate superiors any defects or repairs that should be taken care of, as well as to make recommendations for changes, renewals, etc.

3. Tanks should be inspected quarterly or at least semi-annually by the supervisor of water service, the bridge and building supervisor, the master carpenter or other officer directly responsible for tank maintenance. These inspections should be recorded on an approved form.

The accompanying form of inspection report, which is used by the Illinois Central System, indicates information that should be recorded at the time of inspection:

ILLINOIS CENTRAL RAILROAD

Inspection Report Covering Water Tank at.....
DATE.....
Type..... Size.....Height.....Capacity.....
Date Built.....New or Second Hand Material.....
Foundation Kind.....
Estimated Cost of Repairs.....
Posts Size.....Condition.....
Estimated Cost of Repairs.....
X Braces Size.....Condition.....
Estimated Cost of Repairs.....
Caps Size.....Condition.....
Estimated Cost of Repairs.....
Main Joists Size.....Condition.....
Estimated Cost of Repairs.....
Chime Joists Size.....Condition.....
Estimated Cost of Repairs.....
Tub Kind .....Size.....
Bottom Condition.....Staves.....Condition.....
Estimated Cost of Repairs.....
Roof Kind.....Condition.....
Estimated Cost of Repairs.....
Hoops No.....Kind.....Date Applied.....Condition.....
Estimated Cost of Repairs.....
Ladders—Outside—Size of Side Pieces.....Size Rounds.....
Condition.....
Ladders—Inside—Size of Side Pieces.....Size Rounds.....
Condition.....
Estimated Cost of Repairs.....
Painting—Date Painted.....Condition.....
Estimated Cost of Repairs.....Total Cost Repairs $.....

Flat Hoops Must Be Watched

On roads where flat tank hoops are still in use, special care should be taken to insure that they are properly inspected in order to prevent a possible collapse of the tank due to the deterioration of the hoops. The best preventive of trouble from this

source is to eliminate their use as soon as they have served their purpose and substitute oval, half-round or round hoops. The use of flat hoops has been definitely opposed by the American Railway Engineering Association, the National Board of Fire Underwriters and the Associated Factory Mutual Fire Insurance Companies; however, on roads where they are still in use, they should be inspected carefully to ascertain their true condition as they generally appear to be in good condition even though they may be eaten away on the back side to such an extent as to be worthless.

Coal, cinders or rubbish should not be allowed to accumulate about the base of tower columns or of the riser pipe as this may be the cause of serious trouble. Bases of columns should be filled with concrete or weep holes drilled at the time the tank is erected.

Steel tanks should be carefully inspected on the inside every second or third year to see if pitting and corrosion have not started. This inspection may appear difficult on first consideration, but by using a rope ladder it can be made readily. A new gasket should be provided for the manhole in the event that the old one cannot be used again. After the tank has been drained and the manhole plate removed, the rope ladder can be raised inside the tank through the manhole, hoisted to the top and secured at the trap door in the roof. The sides of the riser pipe, and the bottom and side of the tank can then be inspected.

Painting

With wood tanks, improved appearance is about the only advantage of paint on a tub, as it will probably last just as long unpainted. As a general rule, untreated wood and steel tanks require painting about every three years. Treated wood tanks have the advantage over these types as they require no painting except possibly the hoops and metal work.

With some steel tanks, especially where cold water from deep wells is stored, considerable trouble is encountered from pitting and corrosion on the exterior of the tanks because of condensation in hot weather. These cases can best be handled late in the fall after the temperature has dropped to the extent that the tank ceases to sweat. If the tank has become badly pitted it should be sand-blasted and then painted. It has been general experience that certain kinds of water, or water in certain localities, is more harmful to steel than that in other sections of the country and more care and attention are required when such is the case.

Railway water tanks are in constant service and it is extremely difficult to take such tanks out of service for a sufficient length of time to enable the interior surfaces to be prepared for the application of paint or other protective coatings and allow proper drying intervals, except where two or more tanks are provided. For this reason the practicability of painting the interior as well as the selection of materials to be used, will depend very largely upon the length of time the tank may be held out of service. To dry steel properly so that it may be cleaned and painted and time allowed for paint drying, may require from 5 to 10 days.

Many different forms of protective coatings have been used for the interior of water tanks, with more or less success. These materials can be classified as follows:

1. Paints using linseed oil as a vehicle and various materials for pigment and driers.
2. Asphaltic and coal-tar paints in liquid form.
3. Asphaltic and coal-tar mastics applied hot.
4. Petroleum-jelly compounds, usually containing some rust-inhibitive such as chromium salts.
5. Emulsified asphalts.
6. Portland cement grout.

One manufacturer of steel tanks has advised that his preference for an interior protective coating for steel storage tanks is red lead as it has stood up better than any other material, one reason for this being its ability to withstand the wearing effect of ice in the tank. The principal objections to red lead paint are: first, the length of time required to allow for drying before being immersed; second, its comparatively short life.

The following formula has been recommended as a quick-drying red-lead paint.

100 lb. red lead in oil
1½ gal. boiled linseed oil
3 pt. turpentine
2 pt. liquid dryer

When the paint is ready to apply, add 2 lb. of finely powdered litharge to every gallon of paint. Allow at least one week between the priming and second coats and 48 hr. between the second and third coats, and between the third coat and immersion.

Approximately three years has been indicated as the period that a good coating of linseed oil paint can be expected to provide protection against pitting and corrosion. Linseed-oil paint is valueless as a protective coating in washout tanks on account of the usual quality and temperature of the water, and is of very little use in treated water storage tanks where caustic alkalinity would affect it.

Asphaltic and coal-tar paints do not require as long to dry and therefore do not require the tank to be held out of service as long as when linseed oil paints are used. No definite recommendations in regard to their use are made at this time.

Mastics are usually applied hot over a priming coat of asphaltic paint and range from ⅛ in. to ¼ in. in thickness. They are extremely difficult to apply and for that reason cost considerably more than red-lead paint. However, they indicate a better protection and longer life.

Petroleum compounds with proper inhibitors are comparatively easy to apply and in many cases afford very satisfactory protection.

Emulsified asphalts have been used to some extent, but have not proved entirely satisfactory.

Portland cement grout has also been used to some extent and as a rule has proven very satisfactory, being of special value in the case of treating and boiler washing tanks. The mixture used on one road for grout is as follows:

1½ parts by volume portland cement
1 part by volume of very fine sand
Water to form thick cream

This material requires a thoroughly cleaned surface but after this is done the application is comparatively easy, the grout being applied either with brushes or with a spray.

Repairs

Ordinary repairs on steel tanks which have been properly designed and maintained by painting as outlined above should be very small.

In the case of wooden tanks, the replacement of flat hoops and defective members in the underframe are ordinarily the principal repair items. Defective staves and bottom planks may be replaced by loosening the hoops sufficiently to insert new pieces.

Leaks between the staves or bottom planks are best taken care of inside the tub, by caulking in the joint rather than by using a chisel to start a groove on each side of the joint and inserting soft wood

wedges in these grooves. No attempt should be made to caulk leaks in the chime as this generally will make them worse or ice will pull out the caulking. A circular segment can be cut from a plank to fit the arc of the staves and secured to the floor with long brass screws or lag screws and caulking then done behind this piece, or 2-in. quarter-round moulding can be fastened in the joint between the bottom plank and staves, using brass screws and a waterproofing preparation, several kinds of which are on the market.

One of the greatest sources of trouble with the appurtenances of tanks, such as spouts, is lack of edied to prevent the accumulation of ice, gaskets renewed on leaky tank valves, and frost boxes properly insulated where cracks have developed by warping or shrinking of the posts. Heating plants, when provided as protection against freezing, should be gone over to see that they are in proper working condition. Trouble from ice accumulating in the riser pipes of steel tanks can be taken care of by building an insulated circular enclosure around the leg.

Conclusion

The proper inspection and maintenance of water tanks and their appurtenances depend largely on a lubrication, due chiefly to the fact that adequate means are not provided for the pumper or others to get at the sheaves, etc., to oil. It is good practice to furnish ladders at tanks for this purpose and also to furnish sheave pins equipped with grease cups.

Indicator cords frequently break and for this reason a small brass chain serves the purpose to better advantage.

Trouble from the rusting of metal floats can be corrected by using galvanized iron, or better still, copper. Cedar pile butts, properly trimmed and painted, furnish satisfactory floats in many cases.

In colder sections of the country, inspection and maintenance with reference to operation in cold weather is of great importance. Leaks must be remcompetent and interested supervisory force, combined with a careful programing and budgeting of the work as required.

Committee: E. H. Brown, N. P. (chairman); F. P. Farrell, M. P.; R. C. Bardwell, C. & O.; W. R. Fithian, M. P.; C. R. Knowles, I. C.; J. H. Bugg, C. N. R.; F. M. Case, C. & N. W. (deceased); W. E. Pierce, D. & H.; E. A. LeWald, A. T. & S. F.

Discussion

The discussion of this report centered largely around the relative merits of flat and round hoops for wooden tanks and of the use of cement grout as a paint or patch material for the interior of steel tanks. L. C. Smith (I. H. B.) said that his road has abandoned the use of steel tanks and has returned to

C. S. Heritage
First Vice-President

H. I. Benjamin
Third Vice-President

Bridge and Building Association

Officers 1929-1930

J. S. Huntoon, President, Assistant Bridge Engineer, M. C., Detroit, Mich.

C. S. Heritage, First Vice-President, Bridge Engineer, K. C. S., Kansas City, Mo.

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H. I. Benjamin, Third Vice-President, Assistant Engineer Bridges, S. P., San Francisco, Cal.

W. T. Krausch, Fourth Vice-President, Engineer Buildings, C. B. & Q., Chicago.

C. A. Lichty, Secretary-Treasurer, General Inspector, C. & N. W., Chicago.

Executive Committee

Maro Johnson, Past President.

(Terms Expire October, 1931)

E. C. Neville, Bridge and Building Master, C. N. R., Toronto, Ont.

H. H. Best, Supervisor Bridges and Buildings, M. P., Little Rock, Ark.

J. E. King, Engineer Maintenance of Way, C. & O., Richmond, Va.

(Terms Expire October, 1930)

G. A. Rodman, General Supervisor Bridges and Buildings, N. Y. N. H. & H., New Haven, Conn.

W. A. Batey, System Bridge Inspector, U. P., Omaha, Neb.

F. W. Hillman, Assistant Engineer Maintenance, C. & N. W., Chicago.

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Second Vice-President

W. T. Krausch
Fourth Vice-President

the use of wooden tanks because of the difficulty of maintaining the steel tanks. L. C. Prunty (U. P.) stated that he had found it practical to patch small holes in steel tanks with mortar and described the manner in which he installed such a patch (of 1 cement to 2 sand) at the bottom of a steel tank recently, letting it stand one day and then turning the water in and returning the tank to service, leaving the cement to complete its set under water. He stated that it has been his experience that it was possible by this expedient to avoid the application of patches and the delay in the use of the tank involved and also to extend the life of tanks 10 or more years.

This led to a question as to the efficiency of cement grout paint for use on the interior of tanks, to which Mr. Prunty replied that while this is an excellent paint and will protect steel indefinitely, it will pull off in cold weather due to expansion and contraction with variations in temperature. E. A. LeWald (A. T. & S. F.) advocated the use of cement grout for this purpose because of the fact that with it a tank need be taken out of service for only about three days. In this connection, A. L. McCloy (P. M.) said that through the use of rotary steel brushes and water-proof asphalt paint, he finds it unnecessary to take a steel tank out of service for more than four days for repainting. When he finds it necessary to take a tank out of service for 10 or 12 days for repainting, E. C. Neville (C. N. R.) said that he builds a by-pass from the water main direct to the stand pipe to maintain a continuous supply. In reply to a question, Chairman Brown stated that he did not consider it necessary to paint the interior of a tank used for the storage of water at a lime-soda ash treating plant, as these materials are in themselves rust-inhibitors.

In discussing the merits of flat versus round hoops, Mr. Prunty and A. I. Gauthier (B. & M.) urged that after flat hoops have been on a tank seven or eight years they should be watched very closely and that, as soon as they begin to fail, the entire set should be renewed.

The Relative Advantages and Costs of Precast Concrete Crib Walls and Monolithic Walls

REPORT OF COMMITTEE

T. H. Strate
Chairman

THE advantages of precast concrete cribbing units in retaining wall construction, as compared to monolithic or poured-in-place concrete walls are as follows:

1. Lower cost of installation.
2. Greater speed of erection.
3. Immediate use on completion without waiting for curing as is necessary with concrete poured in place.
4. High quality of concrete scientifically manufactured under strict control methods, only possible in a well organized concrete-products plant where materials and water are properly weighed or proportioned and where proper curing is assured.
5. Can be placed on foundation soils which would require a pile or caisson sub-foundation if a heavy mass wall were constructed.
6. Slight settlement of foundation soil does not injure a cribbing wall when properly designed and erected.
7. Standardized precast units may be carried in stock, in which event their availability in an emergency is invaluable where the time element is a feature.
8. No special equipment is required and erection may be done by unskilled labor.
9. Ease of construction, removal and relocation without loss, allowable increase of height on account of future widening of banks, raise in grades, etc.
10. Provides perfect drainage without the use of tile drains and necessary sewer connections.
11. Precast cribbing has some advantages in congested terminal districts, or where right of way is restricted, where, in the construction of solid walls, encroachment on adjacent track space or private ground would be necessary.
12. Can be used easily and to great advantage when two tracks or roadways are operated on different levels and on close centers.
13. Replacement of wooden cribbing can be handled most advantageously by use of precast concrete cribbing, as one section or cell can be placed at a time with a minimum amount of shoring. In doing this the material excavated for an adjoining cell may be used as back-fill for the one just erected.
14. Minimum amount of excavation for foundation.
15. Can be used to good advantage to retain the fill at switch stands and signal foundations where a solid wall would require deep footings.
16. Can be used for wing walls of bridge abutments along highways, especially where it is likely that the abutments will have to be widened at a later time to accommodate additional tracks.
17. Where precast concrete cribbing may be used the

An Example of the Closed-Face Type of Precast Concrete Cribbing in a Long Retaining Wall

cost is, as a rule, from 25 to 40 per cent less than for a monolithic wall to serve the same purpose.

Comparative Costs

Cost data received by the committee from the Delaware, Lackawanna & Western give the actual cost of concrete cribbing retaining walls constructed at its new freight terminal and warehouse at Jersey City, N. J., supporting the lead track to the warehouse and the estimated cost of a gravity concrete retaining wall to serve the same purpose.

Actual Costs of Concrete Cribbing Retaining Walls (Loading, Coopers E-65 Class)

Material		
25,440 cribbing units, including freight		$62,202.96
44 rolls roofing paper	$108.37	
178 tons of soft coal	561.48	
Miscellaneous	47.79	717.64
Total material charges		$62,920.60
Labor and Work Equipment		
Excavating, grading and surfacing	$2,653.60	
22½ days crane rental @ $7.50	168.75	
		$ 2,822.35
Unloading and handling cribbing	$1,448.48	
Laying up cribbing	6,991.60	
84 days crane rental @ $7.50	630.00	
		$ 9,070.08
Filling in cribbing and back filling	$3,206.97	
26½ days crane rental @ $7.50	188.75	
2 days work train train (B. & B.)	149.57	
7 days work train (roadway)	402.50	
		$ 3,947.79
Miscellaneous charges, labor		525.79
Total labor and work equipment charges		$16,366.01
Total cost		
Material		$62,920.60
Labor and work equipment		16,366.01
Total		$79,286.61

Concrete Cribbing Walls—Data

	North or East Wall	South or West Wall	Total
Length of walls	1,506 lin. ft.	1,348 lin. ft.	2,854 lin. ft.
Maximum height	18'10"	19'9"	19'9"
Minimum height	6'11"	9'8"	6'11"

Concrete Cribbing Walls—Cost Data

Foundation excavation	2,917 cu. yd.	$2,822.35	$0.967 per cu. yd.
Cinder fill (placing only)	20,182 cu. yd.	3,947.79	0.195 per cu. yd.
Concrete cribbing wall	38,407 sq. ft.	72,516.47	1.888 per sq. ft.
Concrete cribbing wall, including foundation excavation	38,407 sq. ft.	75,338.82	1.962 per sq. ft.

Actual cost of concrete cribbing walls—62 per cent of estimated cost of gravity concrete walls.

Alternate Design

Proposed Gravity Concrete Retaining Walls to Serve the Same Purpose as Concrete Cribbing Walls

	Total
Foundation excavation	4,175 cu. yd.
Wood piles (30') creosoted tops	1,737
Concrete class "B"	7,893 cu. yd.
Length of walls	2,854 lin. ft.
Maximum height	20'0"
Minimum height	7'6"
Face area (above footing)	38,116 sq. ft.
Cinder fill between walls	16,516 cu. yd.

Estimated Cost

Foundation excavation	4,175 cu. yd.	@ $ 1.00	$ 4,175
Wooden piles (30') creosoted tops	1,737 each	@ 15.00	26,055
Concrete class "B"	7,893 cu. yd.	@ 12.00	94,716
Cinder fill (placing)	16,515 cu. yd.	@ 0.20	3,303
Total			$128,249

Crib Walls on the Southern Pacific

The Southern Pacific makes the following report on installations at Oregon City and Round Prairie, Ore., and also at Tunnel No. 4 in Oregon:

"We placed one of these walls at Oregon City, where the face was exposed to a swift current at high water and at flood periods and the wall itself was backfilled with rock between the members and immediately back of the front face, the result being that there has been no wash and no trouble with drift.

When the wall was first placed, we found that the pressure where the members rested on each other became so great that spalling of the concrete took place. This trouble was corrected by setting the members in a small quantity of mortar, which set promptly and gave sufficient bearing to avoid this spalling action. The wall itself was placed on a concrete footing. The pockets were backfilled with rock by means of a locomotive crane.

Another installation was made at Round Prairie, Ore., to take the place of a grasshopper trestle, the total length being 290 ft. The wall was first constructed, excavation being done by hand, and the material cast over into the river. Crib units were placed by means of a locomotive crane and hand crab, backfilling being made by means of the crane.

Another installation was made at Tunnel No. 4, where a line change necessitated increasing the height of the existing gravity retaining wall. Holes were drilled through the old wall, near the top, and anchor bolts put through the holes and attached to deadmen in the fill, this being done to strengthen the old gravity wall on account of the increasing of the surcharge. The crib wall was placed on top of the gravity wall, excavation being done by hand.

Crib Retaining Wall on the Lackawanna at Jersey City

Conclusion

The committee makes no suggestion as to the type of crib wall. It is the recommendation, however, that the use of precast cribbing be given serious consideration in retaining walls up to a height of 12 ft. Above this height the decision is left to the judgment of the individual interested. It is not the intention of the committee to suggest that the mass wall be supplanted entirely by cribbing, but there is at this time sufficient evidence to warrant its further consideration and use in railroad construction.

Committee: T. H. Strate, C. M. St. P. & P. (chairman); A. I. Gauthier, B. & M.; W. G. Swartz, C. N. R.; Van S. Brokaw, C. M. St. P. & P.; C. L. Marks, C. & O.; W. R. Roof, C. G. W.; T. E. O'Brien, D. & H.; H. I. Benjamin, S. P.; E. E. R. Tratman, Eng. News-Record; T. W. Pinard, Penna.

Discussion

L. C. Smith (I. H. B.) opened the discussion of this report with a question regarding the economy of crib construction, citing the failure of certain walls built four years ago because of the penetration of moisture

into the concrete, resulting in corrosion of the reinforcement and spalling off of the concrete to such an extent that repairs are now necessary. In reply, L. D. Hadwin (C. M. St. P. & P.) emphasized the necessity for first-class concrete in crib construction because of the small units involved. Concrete for such purposes must be made to very rigid specifications, he said, for it is very difficult and expensive to repair a crib wall after one or more units fail.

In reply to a question as to the reason for the committee's implication that the height of precast crib walls be limited to 12 ft., Chairman Strate stated that at least one failure of a wall 15 ft. in height had come to his attention. W. R. Roof (C. G. W.) stated in rebuttal that on his road walls as high as 18 ft. have been in service for periods up to five years without signs of failure.

This led to a discussion of the causes of failures with these walls, in which F. C. Brackett (B. & M.) stated that whereas he had found no trouble with the walls themselves he had experienced difficulty with the backfilling filtering through the walls, requiring frequent cleaning of ditches and causing fear of ultimate caving back of the wall.

D. B. Taylor (B. & O.) cited a similar experience with a crib wall built along a track to hold back a highway which wall was backfilled with clay that flowed through the wall in sufficient quantity to block the track within four months. A. I. Gauthier (B. & M.) opposed the backfilling of any such wall with clay, stating that it was his practice to insist upon cinders or gravel, even to the extent that the clay be excavated and wasted to make room for the necessary quantity of cinders.

In discussing the relative costs of crib and monolithic walls and also of open and closed face types of walls, J. J. Davis (E. J. & E.) referred to a crib wall built to protect a hopper track between two main tracks at a coaling station, which cost 60 per cent of the figure for a solid wall. Estimates also showed that, for this location, the closed face type of wall cost 10 per cent more than the open face. C. D. Turley (I. C.) described the experience of that road with both the open and closed face types of walls, as a result of which this road has, in recent years, gone largely to the use of the latter type. He indicated preference for this type by reason of its improved appearance and the further fact that fine material will not seep through. He also stated that he had observed that defects developed more readily in open-face walls at places where heavy seepage occurs than where the backfill is dry. Mr. Gauthier attributed such failures to hair cracks in the concrete resulting from improper curing, contending that such cracks afforded entrance for water which attacks the reinforcement.

In spite of the failures that were reported, it was evident from the discussion that many of the railways are finding numerous opportunities to effect economy through the use of crib walls for permanent as well as temporary construction.

The Use of Power Tools and Equipment in Bridge and Building Work

COMMITTEE REPORT

R. D. Ransom
Chairman

THERE ARE many reasons why the tasks embraced in bridge and building work were not readily reduced to mechanical processes. Foremost among these are the diversity of the tasks and the inherent difficulties of effecting the division of labor which characterized the industrial revolution of the nineteenth century. So long as one individual was required to perform many different tasks from hour to hour it was impracticable to provide him with a power tool for each task. But there is an even more important reason for the delay in the introduction of labor-saving equipment in these fields. The portable power units had to await two important developments; the widespread distribution of electricity through the agency of the public service companies and the perfection of the internal combustion engine, whereby direct mechanical power, compressed air or electricity may be supplied economically by prime movers of relatively small size.

The type of machine used for driving piling should, if possible, be capable of doing other allied work such as performing the duties of a derrick. It should be equipped with an air pump for the operation of air tools for boring and sawing and possibly other work, so that it may be kept busy throughout the year and not stand idle a large portion of the time.

It has been fairly well determined that a steam hammer will drive approximately 50 per cent more piling in a given time than a drop hammer and the damage to the piling will be less. The steam hammer should be equipped with false or telescoping leaders, in the case of fixed leaders, so that piling may be driven to within a foot or two of cut-off without the use of a follower, especially when driving pile piers. This is accomplished by the automatic lowering of the false leaders as the pile moves downward below the lower end of the permanent leaders.

It is not always necessary to purchase up-to-date equipment in order to do this. There is a case in which one railway company had a pile driver that was built in 1907, described briefly as a self-propelling steel car with the cab, housing boiler and machinery on the rear end and a turntable over the front trucks supporting two I-beams and light trusses on which the leaders rest when the driver is not in use. The entire outfit, weighing approximately 70 tons, was reconstructed into a combination pile driver and derrick which is kept busy 10 months out of every year, driving piling, and placing concrete pipe and I-beam spans. During the last two seasons, it has shown an annual saving of 600 per cent on the investment of approximately $2,500 in the improvement of the old pile driver.

Some railroad companies find the combination

crane and pile driver quite suitable for their work. It consists of a regular locomotive crane and boom with a truss platform with folding leaders. This crane can readily be converted into a pile driver by removing the boom and attaching a pile driving truss and leaders containing a steam hammer. Piles can then be driven 22 ft. ahead of the forward wheels and 30 ft. from the center of the track. The leaders may be lowered or raised in a short time so that it can be

A Locomotive Crane Equipped for Pile Driving

used where any other type of track pile driver can be used, with a few exceptions such as for driving 60 to 85 ft. piling. There is very little difference in the cost of the crane and boom with the pile-driving attachment and the self-propelled track pile driver.

Steam-operated, self-propelled cranes with 40-ft. booms and 20 to 30-ft. removable inserts to make booms 60 to 70 ft. long are useful. The capacity of these cranes ranges from 25 to 60 tons at minimum radius so that they can be used for handling heavy loads when erecting steel and other heavy work. It is recommended that these cranes be equipped with suitable outriggers for blocking to prevent tipping when handling loads greater than the free capacity of the crane. Cranes can handle about 50 per cent heavier loads with the outrigging blocked than without it, at the same radius. In addition to handling heavy loads, these cranes can be used for handling all kinds of material and for operating clamshell and orangepeel buckets; they can also be used for driving piling.

Pendulum leaders can be used on the boom with a backstay connecting the bottom of the leaders with the base of the boom. With this arrangement, piles can be driven 25 ft. ahead of the front wheels and 30 ft. from the track. A steam hammer is recommended for use with these machines as the cranes are not usually fast enough for drop-hammer work.

Examples of Power Equipment

The following equipment has proved very satisfactory in bridge and building work:

Combination locomotive-crane derrick cars are available which are designed for the placing of long heavy girders and which can lift 100 tons at 85-ft. radius and set a load 20 ft. from the center line of track.

Where only a small crane is required for light work, it has been found that the self-propelled type, commonly used in laying rail in track, is very efficient in handling such bridge material as timber falsework, the removing of old stone masonry and other similar work.

The many hoists now in use for various kinds of work demonstrate their usefulness. The larger ones are generally operated by steam while those of smaller capacity are often powered by gasoline, enabling them to be moved more readily from one job to another.

A considerable saving in labor can be effected if a bridge or building crew is supplied with a gasoline motor car for transporting the men with their tools and materials to the various bridge and building jobs.

Motor trucks may become indispensable in terminals not only to the bridge and building department, but also to other departments. They are especially adapted to use about headquarters or within a radius of 30 to 50 miles. At headquarters, a truck may be kept busy by bridge and building men, electricians, painters, masons, and trackmen, and, in cases of local derailments, may play an important part by running to headquarters for signal material, etc.

During the last few years some of the railroads have supplied several of their crews with portable electric generators and air compressors for operating cross-cut and rip saws and boring machines and for many other operations such as tightening and removing nuts from bolts, and also for furnishing electric light during night work.

A cross-cut power saw, commonly operated from a portable air compressor, is ideal equipment for cutting off piling above and under water. The saws and air drills, together with other air tools, can be used to good advantage on any large bridge or building construction job.

One of the portable electric power outfits with tools costs about $2,500 and will show an annual saving, after deducting for repairs, depreciation and interest on the investment, of not less than 50 per cent of its cost. The portable electric generator weighs about 1,200 lb. and for this reason can be used on small sized jobs, as it can be handled on a push car about as readily as a 6-hp. motor car.

A home-made portable saw table has proved very satisfactory where there is considerable sawing to do.

Portable gas-electric outfits are used for repairing and strengthening bridge members in the field. This method of repairing is in its infancy although we believe it has great possibilities. Work of this kind should be done by thoroughly experienced welders and in no case by amateurs.

The oxygen-acetylene cutting torch is used for cutting all kinds of steel and iron and is especially useful for removing steel and iron structures that are to be scrapped.

Pneumatic tools include a large part of the power-tool equipment that is used by most railroads, some of which are described here. Among these is the combination pneumatic riveting hammer, rivet buster and backing-out punch, the great advantage of which is the fact that it can be changed from a riveting hammer to a rivet buster in about one minute.

Close-quarter air drills are available for drilling and reaming holes in steel and iron up to 1¼ in. diameter.

Power-Operated Wood Boring Machines Are Practical Devices

Wood-boring machines are built for bits up to 1¼ in. diameter.

Paving breakers or demolition tools are used for breaking up heavy concrete and stone.

Jack hammers drill holes in concrete or stone up to 2½ in. diameter.

Portable gas-driven trench pumps are used to remove water from excavations up to 15 ft. in depth. A minimum size pump should be used so that it can be moved about easily.

A wood-working machine with cut-off, rip, dado, and band saw, jointer, mortiser and tenoner, and tongue-and-groover accessories, is a valuable machine for building work.

The cement gun is a unit of equipment that is valuable for making repairs to cracked masonry of either stone or concrete and for repairing disintegrated concrete.

The paint spray machine is also a labor saver. Experience with this machine shows that best results can be obtained by

having men assigned to its use and not changing them, for when a man gets used to operating a machine he can turn out better work and needs to do less brush painting. When properly used, the spray gun gives a better job, especially in close places. We believe the machine painting is better than the brush work, especially on steel bridges, although the spray gun will use about 20 per cent more paint, this being more than offset by the saving in labor.

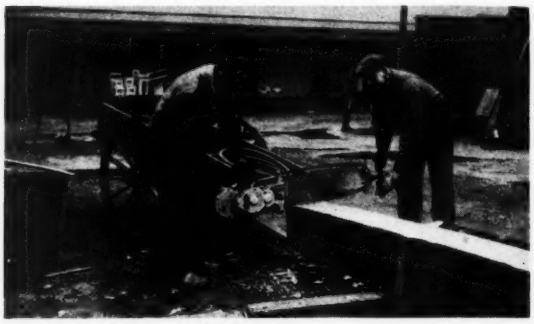
Committee: R. D. Ransom, C. & N. W. (chairman); E. E. Candee, N. Y. N. H. & H.; A. Sweet, A. T. & S. F.; J. B. Livingston, St. L. S. W.; Sam Lincoln, G. C. & S. F.; J. F. Lockwood, C. & O.; J. P. Hofacker, L. V.; and C. W. Boyce, Y. & M. V.

Discussion

In discussing this report W. A. Batey (U. P.) stated that a road pays for power tools whether it buys them or not. He added that the programming of work enables equipment of this character to be concentrated in certain specialized gangs and then used for the maximum period. Such equipment, he added, not only reduced costs but shortens the period of interference with traffic.

C. M. Burpee (D. & H.) questioned the committee's statement to the effect that a paint spray uses 20 per cent more paint than a brush. E. C. Neville (C. N. R.) added that he has found that a spray gun seldom uses more paint except when working in the wind and even this loss can usually be avoided by shields.

A. I. Gauthier (B. & M.) advocated the use of vibrators and power tampers for the removal of air bubbles from concrete, stating that he had found that they added greatly to its uniformity and appearance. In this connection F. C. Brackett (B. & M.) described the economy that he has secured through the purchase of ready-mixed concrete in terminal areas at Boston, this concrete being delivered at the time and in the quantity desired, at a price that effects a saving of $8 per cu. yd.



A Convenient Power Cross-Cut Saw

The Modernizing of Station Buildings

COMMITTEE REPORT

F. H. Soothill
Chairman

IN remodeling and modernizing an existing passenger station, the type of architectural design to be followed is largely determined by existing construction details of the building to be improved. Ceiling heights, roof lines, doors and windows, etc., are important factors in determining the architectural treatment. Very often, however, community organizations and governing state bodies having jurisdiction over railroad building matters dictate to some extent the size, type and construction which shall be employed. Usually existing structures can readily be converted into modern buildings of pleasing appearance by the application of stucco or brick veneer, by regrouping windows and doors or installing new ones, and, in certain cases, by altering the roof lines. If a particular style of architecture is required for a certain locality, the problem is more difficult. An existing structure may be of such proportions that the cost of alterations to adapt it to a given architectural design or to modern needs would be prohibitive. In such a case it may be advisable, from the standpoint of economy, to erect an entirely new building.

In the case of a frame station building, the physical condition of the structure should be carefully examined to determine what repairs are required to place it in good structural condition after stripping and prior to remodeling. In a brick building, the structural condition is sometimes less difficult to determine.

When a frame structure is to be refinished in either stucco or brick veneer, a new concrete foundation is usually required, as most frame structures are on wood foundations which are not adapted to stucco or brick-veneer buildings. Usually existing windows and doors are of such size and design as to require complete replacement in order to obtain the proper architectural treatment of the remodeled structure. Existing roof lines and roof construction demand careful consideration, because the roof frequently requires considerable remodeling to make it harmonize properly with the architectural treatment of the remodeled structure.

If sewerage and water are available, modern plumbing fixtures are usually installed in a remodeled structure, as most communities now demand modern sanitary facilities. Modern heating systems, such as those utilizing steam or hot water, usually replace stoves for heating station buildings.

Current Tendencies

Among the interesting tendencies in modern passenger station design is the preference for one general waiting room in place of separate waiting-room facilities for men and women. In stations serving larger communities the general waiting rooms are often supplemented by women's retiring rooms.

The general practice in remodeling the exterior of stations appears to be evenly divided between covering the walls entirely with stucco and applying brick veneer up to the window-sill line and stucco between this point and the frieze.

In most of the examples under consideration, it was necessary in connection with the improvements,

to reconstruct the foundations, renew the windows and doors, apply new roof coverings, renew the interior wall linings, replace interior trims, renew the floors, install sanitary plumbing, install modern heating systems and rewire the buildings for electric lighting.

The most common practice in applying stucco to the exterior of the buildings is to fur out over the existing weatherboarding and apply metal lath as the stucco base. This operation, of course, increases the thickness of the walls and makes it necessary to place a band molding around the existing doors and windows, if they are still in serviceable condition, or, if not, to renew them entirely.

Two views of the Missouri Pacific Station at San Benito, Tex., showing its original appearance (above) and as it looks today after remodeling (below)

With brick veneer, a one-inch air space is generally allowed between the weatherboarding and the back of the brick, anchorage being obtained by means of metal clips fastened to the surface of the building at regular intervals. In some cases, where a combination of brick and stucco is employed, furring under the stucco is made of sufficient thickness to bring the finished surface to the same plane as the brick dado below.

Several railroads have improved brick masonry structures by applying both stucco and brick facings to the exterior. Brick buildings lend themselves readily to exterior stucco treatment without the necessity of incurring expense for additional foundations.

Apply Better Roofing

A uniform practice is observed in the replacement of combustible roofing materials with non-combustible materials of the better types in the following order of preference; asbestos shingles, Spanish clay tile, slate and asphalt shingles. Coupled with the foregoing improvement is the tendency to reduce eave projections, thereby permitting better interior lighting and ventilation and at the same time reducing the area of exterior painting and roofing to be maintained.

A decided trend is observed toward the use of concrete floors throughout passenger and freight stations. With structures that have floor joists and girders in good condition, and under which ventilation is assured, concrete can be applied directly over the existing floors successfully after first applying wire lath or mesh.

If existing conditions do not permit raising the finished elevation of the floor four inches, the wood floor can be removed and let down between the joists, where it will serve as a foundation for the concrete wearing surface. Where this method is employed it is advisable to chamber the tops of the joists and reinforce the concrete with wire mesh.

In waiting rooms, retiring rooms, etc., where it is desired to introduce color, the top surface of the floor may be tinted to any desired shade. Tile patterns can be carried out by checking off the concrete before setting takes place.

Some railroads, in more extensive alteration plans, have applied terrazzo tile floors over a reinforced concrete sub-base, usually supported on the wood floor construction. Other roads have resurfaced existing wood floors with composition flooring, of which several reliable makes are available. Composition floors are generally laid monolithic over metal lath secured to the wood floor. Passenger stations were formerly constructed with greater ceiling heights than are in vogue at the present time, and a survey shows that railroads have found it of considerable economic advantage to reduce ceiling heights in extensive station alterations.

Favor Wall Board or Plaster

The trend seems to be away from the use of wood lining on the interior of station buildings when improvements are undertaken. In the majority of the cases considered, plaster was used to replace wood ceilings. Several railroads, however, used wall board, in both a wood panel design and a rough texture effect, the latter being obtained through the use of plastic paint.

In practically all the modernized stations under consideration, the sanitary facilities were either installed as new units or, in the case of existing facilities, completely renewed. Many railroads have found it more economical to install metal water-closet stalls in place of slate or composition compartments. Hot-water heating plants appear to predominate in passenger stations, followed closely by steam-heating plants.

In western and southwestern territory, where natural gas is available, the trend appears to be toward the employment of gas-fired boilers. Most of the heating installations which were studied had boilers located in depressed pits, either in the baggage rooms or the freight rooms. Comparatively few new basements were constructed to house heating equipment.

Cost data submitted by 15 railroads in various parts

of the country, giving the expenditures for reconstructing stations and the estimated cost of building new structures of the same character and size, show that:

For three railroads the investments in remodeled stations were less than they would have been if entirely new buildings of similar size and design had been constructed.

For six railroads the investments in remodeled stations were the same as they would have been if entirely new buildings of similar size and design had been constructed.

For six railroads the investments in remodeled stations were more than they would have been if entirely new buildings of similar size and design had been constructed.

After having reviewed the plans and reported the costs of the improvements submitted by the railroads, the committee cannot help but feel that a number of the remodeling projects would not have been undertaken if the managements of the respective railroads had known in advance what the actual cost of alterations would be as compared with the cost of constructing new stations.

Of course, the committee appreciates the fact that the remodeling of an old station at a cost in excess of that of a new structure in cases where there is a local demand for elaborate new facilities might be justified. On the other hand, we have reason to believe that in many cases the full extent of the work necessary in rehabilitating old structures is not realized until after the work is authorized.

Committee: F. H. Soothill, I. C. (chairman); A. J. Hayes, C. B. & Q.; A. O. Lagerstrom, C. M. St. P. & P.; F. M. Lehrman, C. & N. W.; T. D. McMahon, G. N.; Kemper Peabody, N. Y. C.; A. B. Niles, M. C.; C. W. Wright, L. I.; F. T. Stafford, G. C. & S. F.

Discussion

It was evident from the discussion that most of the members did not look with favor on any proposal which involved extensive alterations to old buildings because of the difficulty of determining with any degree of accuracy the full extent of the work to be done. T. Turnbull (A. A.) emphasized the impossibility of attempting to estimate the cost of remodeling an old building for one always finds obstacles that cannot be anticipated.

Beyond this point the discussion was confined largely to the narration of expedients by which various members had improved buildings on their lines and the troubles that they had encountered, particularly with the use of stucco on metal lath. Chairman Soothill called attention to the growing trend toward the installation of pay toilets because of the reduced expense for maintenance, the better condition in which they are maintained, the added income derived therefrom and the curbing of their use as public comfort stations.

Maintenance of Turntables and Drawbridge Machinery

COMMITTEE REPORT

A. E. Bechtelheimer
Chairman

ALL TURNTABLES should be given a general inspection at least once each year by the system or district bridge inspector, and also by the division engineer and the bridge and building supervisor or master carpenter, on their respective divisions. These inspections should cover all features relating to the maintenance of the facility, and should be made specifically to determine whether it is being operated and maintained properly.

A monthly inspection should also be made by the local bridge and building foreman. This should be a minute inspection of the structure, with special reference to bolted connections, the condition of the end wheels and bearing boxes, oiling of the center and end wheels, and adjustment of the table with respect to the circle rail and the rails on the table and approach tracks.

The bridge and building supervisor or master carpenter should make additional inspections when reports from the bridge and building foreman indicate that they are necessary. Likewise the system and district bridge inspectors and the division engineer should make additional inspections when reports from the supervisor indicate that they are necessary.

The master mechanic and the roundhouse foreman should keep a close watch on the operation of the turntables at their terminals and report to the division engineer or proper supervisory officer any difficulties coming to their attention.

Maintenance and Care

The bridge and building crews should take care of all general maintenance work, such as repairs to the deck, circle wall timbers, rails on the table and the circle rail, and also the cleaning and painting of the structural steel.

The steel bridge erection crew should take care of all structural steel repairs to the table and tractor frame. The shop electrician should take care of repairs to the electrical equipment, calling on the electrical engineer for assistance when this is necessary. The master mechanic should take care of repairs to the tractor machinery. The roundhouse foreman should be responsible for the manner in which the table is operated, for the proper handling of engines across the table, and for keeping the turntable pit and drainage sump clean and free of debris.

The roadmaster should see that the tracks leading to the table are kept in good surface, properly supported, and anchored against movement affecting the adjustment with the rails on the table.

The Center

The center pier must afford a level, firm and unyielding foundation for the center. As the center is a vital unit of the facility, it requires special attention. This cannot be over-emphasized. The inaccessibility of the working parts is a handicap which seems to invite neglect of the center. It is essential that the working chamber be kept clean and free of water, dust, soot or other foreign matter, and be kept filled with a good grade of lubricating oil. The bridge and building foreman should see to these details on each monthly inspection. This can be done by open-

ing the drain plugs, draining the water out and examining the oil.

The table must be lifted and the working chamber opened to insure thorough cleaning. This should be done at least once a year, and at terminals where the service is heavy this should be done every six months. Many tables at important points are lifted every three months. Most types of disc centers can be cleaned reasonably well by flushing with kerosene, but generally the roller-type centers cannot be cleaned properly without lifting the table. It appears that some designers of turntable centers do not realize the necessity for designs which will permit flushing and proper cleaning without lifting the table.

Some of the defects found in the inspection of roller-type centers are broken live rings and radial pins; worn thrust washers; chipped or broken rollers; evidence of unequal bearing over the entire length of the rollers, as well as over the entire width of the treads, as shown by checking and flaking of the metal; treads worn level with or below the level of the adjoining surface of the casting; and cracked base castings.

There appears to be a wide variation in the service records of turntable centers. On one road, centers at certain points are removed at the end of 12 months' service, and at other important terminals they are removed for reconditioning every two or three years, at a cost of from 25 to 50 per cent of the cost of new centers. Another road reported as follows: "In the last 25 years but very little reconditioning and no replacements of centers have been necessary." Our survey indicates that the general practice is to make minor repairs and replacements during service and to re-condition in railway or bridge company shops after removal from service. Some roads design their own centers and manufacture them in their shops.

Replies to a questionnaire show a wide variation in the grades of oil used for the lubrication of centers. It is essential to see that the grade of oil specified is furnished and that sufficient oil is used to insure good lubrication.

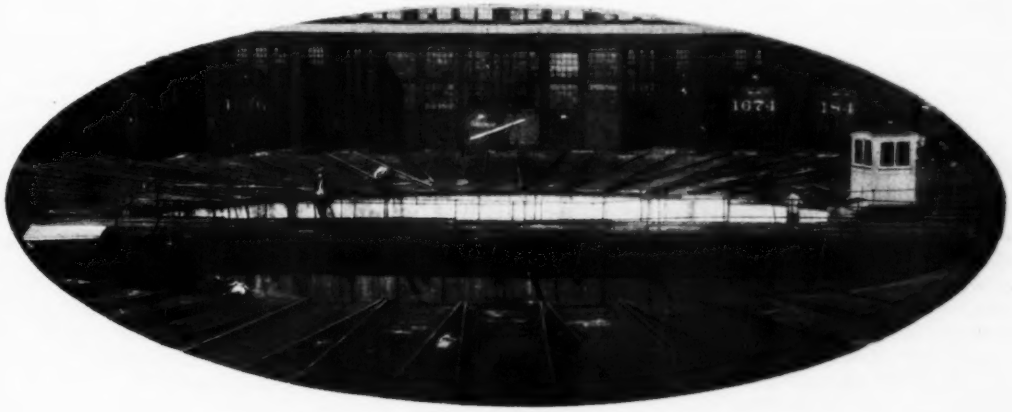
Structural Steel

The steel structure of the table is very much overstressed in many cases, because new installations have not kept pace with increased loadings. Defects occurring in the loading girders are the distortion of the bottom flanges at the edges of the saddle casting, horizontal cracks in the webs near the tops of the bottom flange angles, and wear on the lower ends of the stiffener angles. Defects occurring in the end carriages are broken angles and bent flanges at the bearings of main girders and at points where end wheel boxes are attached. Excessive deflection of the main girders occurs in many of the old installations.

The bracing system, which is subject to unusual deterioration, should be cleaned and painted frequently.

End Bearings

The end bearings of balanced-type tables require an unusual amount of attention. On inspection, one is almost sure to find loose bolts, worn wheels and bearing boxes, worn or broken shafts, dirty packing in bearing boxes, and indications of insufficient lubrication. In balanced-type tables many designs provide wearing surfaces of steel against cast iron in bearing and in end thrust.



Proper Care of Turntables Will Result in Marked Savings

These conditions should be corrected by the introduction of bronze bushings in the upper bearing boxes, by putting babbitt in the lower boxes, by increasing the diameter of the shafts, by changing the design of bearing boxes in certain cases, by providing improved oiling facilities, by frequent replacement of the waste packing and careful attention to oiling, and by keeping dust guards in good condition and closed to keep dirt out.

Good support and anchorage of the circle rail should be provided to insure correct surface and alinement and especial effort should be made to keep the rail at the proper distance from the center of the table. These things are of vital importance in the three-point support types of tables.

The Pit

Adequate drainage of the pit is essential to prevent flooding, which flushes out the oil and deposits sediment in the center, making it necessary to lift the table and clean the chamber. Paving of the pit floor is desirable to aid in keeping the pit free from accumulations of dirt and debris. A paved pit, adequately drained, can be kept clean by frequent flushings with water. Jacking piers of concrete, jacking brackets on the girders, and suitable jacks are requisites for efficient lifting operations. Maximum clearance between the bottom of the table girders and the pit paving is advantageous in affording light for

cleaning and proper care of the table, especially where decks are planked solid.

Rails on the pit wall and on the table should be kept properly adjusted at all times and the gap between the rails at the ends of the table should be maintained at a clearance of one inch. It is good practice to have the tractor end of the table weighted in order to make the wheels ride the circle rail, and to enter engines on this end only.

Deck and Table Rails

A deck with a solid floor or a tight-fitting cover aids very much in keeping the table clean and free from refuse. However, this increases the load on the center considerably and shuts off light, which is needed for the proper inspection and care of the table.

The rails on the table should be in good surface, anchored against end movement and properly supported at the ends of the table. Battered and worn rails at the ends of the table cause damage to carriages, bearings and circle rail. Steel bearing plates should be provided under the rails at the ends of the table and on top of the pit walls.

Power

Electric current is brought to the table either through underground conduits with a collector head at the deck of the table, or by overhead wiring to a collector head supported on a frame above the table. The underground connection seems to have been more generally used when electricity was first applied to tables while the overhead collector is being used on nearly all new installations and in many cases for replacements. However, two roads reported that they found the underground connections more desirable than the overhead collector.

Detached tractors are, in general, very satisfactory. The tractor frame requires no unusual attention. The machinery and motors require servicing and reconditioning at somewhat definite intervals.

Three-Point Support Tables

The three-point support table is far superior to the balanced type table from an operating standpoint. This type of table has been used for the last 15 years by some roads. The circle rail requires a very much higher standard of maintenance than the balanced type table has received.

Conclusions

The necessity for a trained organization for the maintenance and care of turntables does not seem to be generally appreciated by the railways, in spite of the fact that most roads have trained organizations to look after scales and motor cars. The conclusions of the committees are voiced in the following, which is quoted from one of the replies to the questionnaire:

"There is no doubt that an organization accustomed to the design, erection and maintenance of turntables can effect great savings to any railroad.

Drawbridges

The inspection of drawbridges should be handled in the same way as for turntables, except that the master mechanic and the roundhouse foreman do not ordinarily participate in drawbridge work.

Committee: A. E. Bechtelheimer, C. & N. W. (chairman); C. A. J. Richards, Penna.; J. J. Wishart, N. Y. N. H. & H.; H. A. Gerst, G. N.; L. B. Alexander, M. C.; W. V. Parker, St. L. S. W.; R. W. Johnson, C. M. St. P. & P.; B. M. Whitehouse, C. & N. W.; and H. H. Ueckert, S. P.

Discussion

In opening the discussion on this report President Huntoon called attention to the fact that when a turntable goes out of operation the enginehouse and, in fact, the terminal is put out of service. T. Turnbull (A. A.) deprecated the fact that the maintenance of turntables is not taken sufficiently seriously by the average supervisor, with the result that they receive little or no attention until they break down. He urged more frequent oiling, a detail that is all too frequently left to roundhouse forces.

A. I. Gauthier (B. & M.) stated that it is the practice on his road for each turntable to be inspected monthly by the foreman working nearest it. He added that a graphite cup grease is used in the live rolls in the center because of the fact that clear oil will not withstand flooding. E. C. Neville (C. N. R.), on the other hand, uses a good grade of castor oil which is changed twice yearly and at that time all water is drained out and the rollers and the base scoured thoroughly. He did not believe that it is necessary to jack up the table more than once each year, even where it is used as frequently as every six minutes throughout the day.

A. L. McCloy (P. M.) deprecated the difficulty which he encountered in getting the mechanical department to release a table when he needed to jack it up for inspection. J. P. Hofecker (L. V.) stated that by using a locomotive crane or a wrecking derrick it has been possible for him to lift a table and renew a broken center in as short a period as 1 hr. and 20 min.

In discussing the relative merits of the balanced and three-point supported tables, F. E. Schall (L. V.) called attention to the fact that the advantage of the three-point table is not primarily in its decreased cost of maintenance but rather in the greater rapidity of operation by reason of the elimination of the necessity for balancing locomotives on the table.

Flower Bed at the Grand Trunk Passenger Station in Battle Creek, Mich.

Camp Cars and Their Equipment for Bridge and Building Crews

COMMITTEE REPORT

C. M. Burpee
Chairman

IN REVIEWING the practices of various railways with regard to the condition of their camp cars for bridge and building forces, the committee has received information from 87 railways, representing approximately 250,000 miles of line. Slowly but surely the old ramshackle, dark, leaky-roof, sliding side-door box car is being replaced by cars which afford their occupants light, clean, sanitary quarters suitably screened in summer, ventilated and properly heated in winter, while recreation quarters have discouraged the bunk-side poker games. The words of a western committee member aptly describes conditions in that section: "In my opinion, the days of the bridge stiff and bundle stiff on the western roads are gone forever. The new day has brought a new relationship between management and men."

The providing of suitable camp cars for bridge and building crews is governed by a variety of conditions, some of which are general while others vary with locality and environment, such as the desirability of conforming to the racial or social habits of the men.

Classes of Equipment

It is quite important that camp cars should be well constructed and properly maintained, that they may be ready for an emergency movement at any time. It is interesting to note that 11 railways are now using coaches, converted for camp-car uses. Thirty-six others use coaches and box cars, while 23 roads use converted box cars. The Great Northern and the Northern Pacific report the use of coaches and also of box and refrigerator cars which afford proper insulation in their respective territories, while the former road has retired all 33-ft. cars from service and has replaced them with larger ones which provide more room and air. The Charleston & Western Carolina, the Detroit, Toledo & Ironton, the Elgin, Joliet & Eastern, the Gulf, Colorado & Santa Fe, and the Kansas City Southern report that certain of their outfits have been designed and built new.

The change in housing methods has not developed overnight, but has been a gradual transition which has resulted in utilizing obsolete coaches, baggage and Pullman cars and in replacing old box cars with larger ones of the steel underframe class. The Los Angeles & Salt Lake has designed camp cars with steel underframes and rebuilt box cars. It is interesting to note that the new designs eliminate side doors, the entrances now being in the ends. This eliminates two doors, affords more space for the placing of fixtures and apparently has merit from a safety standpoint, for the swinging of screen doors along the sides of the cars in the pathway of trainmen is eliminated and employees no longer find an opportunity of sitting in side-door openings while their outfit is in transit.

The design of camps necessarily varies with climatic and other conditions. For instance, on the National Railways of Mexico it has been found that men are more contented and will work longer if provisions are made for the accommodation of their families. It is therefore the practice to assign two families to a box car. Crane operators of the Delaware & Hudson are assigned remodeled coaches suitable for family occupancy. The Canadian Pacific cars are of coach and box types of various designs, with a minimum of 150 cu. ft. and a maximum of 250 cu. ft. of space allowed per man. The design of camps varies, to provide for gangs ranging from 4 to 18 men in number.

A further indication of the interest that is being manifested in better cars is that 28 per cent of the roads answering a questionnaire are now providing utility or recreation rooms. The Wabash and the Ann Arbor have camps heated with hot-water systems and the latter road supplies its cars with double windows as additional insulation for cold weather. These camps are also provided with gas-engine generator sets for electric lights, as are cars of the Great Northern. Thirteen other roads have camp cars which are wired and furnished with electricity when so located that connections may be made.

Forty-one per cent of the roads reporting are furnishing their men with individual lockers. The St. Louis-San Francisco, the Southern, the Wabash, the Erie, the Great Northern, the Gulf, Colorado & Santa Fe, the Missouri Pacific, the Mobile & Ohio, the Boston & Maine and the Duluth, South Shore & Atlantic are now furnishing steel lockers. These are more sanitary and easier to rid of vermin since very little opportunity is offered for breeding places. The camp coaches of the Western Maryland are provided with roof ventilators and latrines. Lehigh Valley and Pere Marquette camps are furnished with sanitary chemical toilets. Practically all roads provide screens for summer use. The Alaska Railway, the Central of Georgia, the Union Pacific, and the Wheeling & Lake Erie are among the 11 roads which provide bathing facilities. These are very desirable and may be installed at very little expense. The Elgin, Joliet & Eastern cars are equipped with latrines and are disinfected weekly with a commercial insecticide, while it is a practice of the Western Pacific to fumigate all cars thoroughly at definite intervals, and regular inspections are made by the supervisor of labor to insure cleanliness and sanitation. On the Norfolk Southern the medical examiner makes a similar inspection for the same purpose. On other roads, the supervisory officers make regular inspections, a proceeding which cannot be overdone. Cars should be maintained in good condition, cleaned regularly and kept free from all vermin. The cars of the Central Vermont are thoroughly cleaned and painted every year. Supervisors should also enforce

regulations whereby the right of way immediately adjacent to the camps should be kept free from debris and undesirable accumulations of scrap of all kinds.

Arrangements for Feeding

Several different means of feeding the men are in vogue. Fifty-six per cent of the roads reporting advise that it is their practice to hire the cooks and in these instances the actual cost of supplies is prorated among the men, with costs varying from 14 cents to 30 cents per meal; in the majority of cases the cost ranges from 20 cents to 25 cents. The commissary system is used by 11 per cent of the roads, with costs ranging from 23 cents to 60 cents per meal; the same number of roads report that they do not provide any system of feeding and it devolves upon the men to make their own arrangements. Under such conditions, meals cost from 20 cents to 45 cents each. The foreman boards the men in 15 per cent of the instances reported, with costs varying from 25 cents to 45 cents per meal.

Eleven per cent of the roads reporting do not furnish dishes or cooking utensils. Table dishes in the majority of cases are of heavy hotel-type china. The Southern Pacific lines furnish enamel and tinware, while the Norfolk & Western supplies agate and aluminum. Replies indicated that 86 per cent of the railways furnish ice-boxes or refrigerators with their kitchen facilities.

Sleeping Quarters

Our study indicates that dark, grimy bunk cars, equipped with wooden berths which are veritable breeders of vermin, are being superseded to a very great extent by larger and lighter quarters provided with steel berths. Eighty-nine per cent of the roads report that steel berths are now standard equipment. The number per car varies from 4 to 16, depending on the size of car. Thirty per cent of the roads are now supplying bed clothes and 18 per cent provide for laundering, either in railway laundries or through the collection and delivery by commercial laundries located at central points. Fifteen per cent report that they furnish mattresses only, while 55 per cent do not furnish any bed clothes.

Water Supply

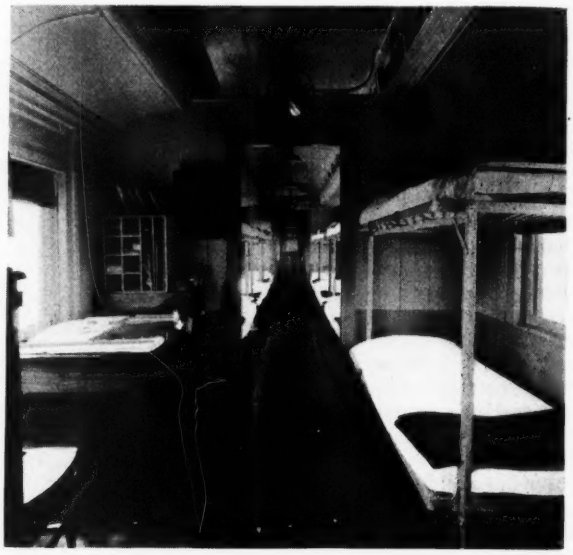
The size of the gangs and the physical characteristics of the country in which they are located in many instances govern the method of water supply. Many of the northern roads in the eastern and central sections traverse heavily wooded country with streams and springs at frequent intervals, which insure an adequate water supply, especially for small gangs. Fifty-three per cent of the railways do not have any special means of providing water; of the remaining 47 per cent, several different methods are employed. The Western Pacific, the Sacramento Northern, and the Midland Valley use tank cars from which the water is piped to kitchens and lavatories. Many roads employ overhead tanks of 50 to 60 gal. capacity and these in turn are supplied from large tank cars carrying several thousand gallons, by hand or gasoline pumps. Two railways have equipped tank cars with automatic electric pumps as sources of supply.

Tool and Supply Cars

Several railways are extending their good housekeeping methods to their tool and supply cars. The Atlanta & West Point, the Lehigh Valley, the New York Central, the Pere Marquette and the Delaware & Hudson are now using obsolete baggage cars for this purpose. In some instances where two box cars were formerly required to house the necessary tools and materials, one baggage car serves the purpose.

The Last Five Years

Many railways have devoted considerable time to the study, design and construction of boarding-car equipment during the last five years. The Illinois Central has adopted standard designs for converting



Foreman's Room and Sleeping Car, Delaware & Hudson

coaches and box cars into boarding equipment. Diners are supplied with built-in refrigerators and overhead water tanks, while two cypress tanks of 700 gal. capacity each are carried on a flat car which forms a combination water and material car. Bunk cars accommodating eight men are equipped with double-deck steel bunks and individual, built-in wooden lockers.

During the early part of 1929, the Boston & Albany adopted standard designs for camp-car outfits to be made from obsolete coaches, providing such improvements as recreation quarters, individual lockers and wiring for electric lights. The Oregon Short Line drew up standard plans for the conversion and rebuilding of camp cars from coaches and box cars in 1928. The Union Pacific redesigned tool and boarding cars in 1929.

During the latter part of 1928 the Atchison, Topeka & Santa Fe completed a bridge and building camp car unit, consisting of six cars, arranged in the following order:

One 42-ft. tool car.
One 52-ft. bunk car.
One 52-ft. recreation and commissary car.
One 52-ft. cook and dining car.
One 42-ft. foreman's car.
One 34-ft. coal and water car.

These cars were built on standard steel underframes. The tool car is well furnished with racks and bins, a portable forge, anvil, vise, and work bench. Bunk cars have six single and four double steel bunks and individual steel lockers. The recreation and commissary car contains a washroom provided with an oil heater for heating water stored in overhead tanks, supplying six wash basins and a

shower bath with hot and cold water. A large refrigerator is built in one end of the commissary compartment. Quarters are provided for the cook in one end of the dining car.

Southern Railway Camp Cars*

Twelve years ago the Southern adopted standard plans and specifications for the conversion of plain 33-ft. box cars of its or affiliated lines into camp cars. Before conversion, all defective parts are restored and all framing is of merchantable yellow pine. The construction includes roofs of double thickness T. and G. boards with felt between; $\frac{13}{16}$-in. yellow pine floors securely blind nailed, and sidewalls and ceilings covered with $\frac{13}{16}$-in. by 2¼-in. beaded yellow pine ceiling. All windows and doors are of pine. Both exteriors and interiors are painted gray.

All white bridge and building forces are provided with camps composed of a kitchen-diner, a foreman and force bunk car, and a shop and tool car. Where the force is composed of both white and colored members, an additional laborers' bunk car is furnished to house the colored men. The kitchen and dining car has two center side and two end doors, 2 ft. by 6 ft. 4 in. and ten one-light 18-in. by 20-in. sliding windows, screened; eight galvanized iron ventilators spaced 7 ft. on centers are provided in the roof, four on each side. The interior is divided into three compartments by cross partitions. An end room provides a bedroom, with a single steel bunk and steel locker for the cook, a small pantry being partitioned off in one corner. The kitchen is 10 ft. 4 in. in length. Water is provided for kitchen use from a water storage tank of 85-gal. capacity, suspended beneath the kitchen floor. A hand air compressor is connected to this tank by a ¼-in. line and an air pressure of 10 lb. on the storage tank supplies water to a 30-gal. range boiler and a kitchen sink. When the camp is so located that connection may be made with a city or other pressure supply, gate valves are provided to disconnect the storage tank. The dining room occupies the other end of this car and is 16 ft. 8 in. long. China and tin dishes are used. The company hires the cook and the cost of the supplies is prorated among the men, the average cost of meals being about 20 cents.

Camp Car Outfit on the Midland Valley

The foreman and force bunk car is also divided into three compartments by cross partitions. Sleeping quarters, 19 ft. 9 in., in length, occupy one end, with five double-deck steel bunks and individual steel lockers. Sliding windows of two 10-in. by 12-in. lights are provided for each bunk and all are screened. The next compartment is 7 ft. 3 in. long and contains a caboose wash stand and water cooler and a stove on a concrete base. Leading from this compartment are two side doors with four lights, as well as end doors. The foreman's room is 6 ft. 10 in. in length and occupies the remaining end of the car. Ventilators are provided similar to those in the dining car while 16 windows, in addition to the two side doors with four lights each, supply light and sunshine. The company does not furnish any mattresses or bed clothes and the laundering thereof is taken care of by the men.

The shop and tool car has two side door openings 6 ft. wide with two sliding doors each, in addition to end doors and a neat standard arrangement of racks and bins, as well as shop quarters, separated by a partition and furnished with portable forge, grindstone, machinist bench with a portable anvil, tool grinder, and vise, a carpenter bench, shelves and a caboose stove.

Western Union Camps

The Western Union Telegraph Company has several admirable camps in service which are of interest to bridge and building men in that their design is particularly adapted to use by bridge and building forces. The outfit consists of four cars, two for living purposes, which are of the converted Pullman car type, a water-tank car of the cylindrical type and a combination tool car. The exterior, painted Pullman green with yellow lettering and varnished, presents a very striking and pleasing appearance. The interior woodwork of the household cars is stained and varnished while the panelwork of the ceiling is finished in old ivory. The kitchen forms a room in one end of the diner, and is large, well lighted and has plenty of cupboard space, with monel metal-covered work bench, a white enameled sink, and a large dining-car type range with a ventilator hood. An automatic electric water pump is located under the sink and an electric exhaust fan in the deck opposite the range. The dining room presents a pleasing room with three small tables, each seating six persons and placed in a transverse position in the car. A large electric fan is located in one end of the room. At the end of the dining room is a storage closet for canned goods and supplies. A shower room opens from a corridor which leads past the cook's room, furnished with a steel locker, steel bed and chair, to the washroom, which has five white enamel lavatories.

The sleeping car is divided into three compartments. The first forms a living and locker room and is furnished with steel lockers, tables, chairs, and a water cooler. The sleeping compartment has four double-deck steel bunks equipped with springs, mattresses, sheets, pillows and cases, and heavy blankets, on each side of the car. The end compartment forms the foreman's quarters and is furnished with a steel bed with bed clothes, a desk, a filing case, chairs, steel lockers and a white enamel wash basin, while a private toilet is located in the adjoining vestibule. Lighting arrangements are well taken care of in both cars and include wall bracket lights as well as ceiling fixtures; sliding doors in the dividing partitions of the sleeping car conserve space and form a very neat arrangement. Inner sash provided with screening are in place at each window opening. Hot water heaters are located in the recreation and wash rooms respectively and radiation is in the form of wall radiators, while fire extinguishers are to be found in the living room and tool car. The outfit visited by members of the committee had polished hardwood floors which showed every indication of

*The report also included descriptions of camp car equipment of the Delaware & Hudson and the Kansas City Southern, described in *Railway Engineering and Maintenance* for July, 1929, page 248, and also the equipment of the Detroit, Toledo & Ironton which was described in the issue of July, 1927, page 295.

proper care. The tool car is 50 ft. in length, built new with steel underframe and two compartments, the first of which is located adjacent to the kitchen and contains a large refrigerator and cupboard for kitchen supplies. The second compartment contains a generator and storage batteries for electric lights and power for the electric pump and fans; a coal bin, caboose stove and a standard arrangement of racks, bins and work bench. Men are fed by the company, which hires the cooks, usually man and wife, and authorizes the buying of all supplies from a central office.

Conclusion

The design and construction of modern, healthy and sanitary camp car equipment must be accompanied by adequate camp rules and supervision and inspection that will insure good housekeeping and proper discipline. With such a system in vogue there is not the slightest doubt but that returns, in the form of increased efficiency, reduction of labor turnover, and a spirit of satisfaction among the employees, will be far in excess of any reasonable expenditures that may be made for improvements.

Committee: C. Miles Burpee, D. & H. (chairman); G. M. Haley, U. P.; L. G. Byrd, M. P.; E. L. Hawkins, S. P.; E. M. McCabe, B. & A.; T. E. Snyder, B. R. & P.; Chas. Harrison, M. V.; W. A. Stewart, C. V.; H. Cunniff, D. & H.

Discussion

In opening the discussion of this report, T. Turnbull (A.A.) stated that the movement for the improvement of camp cars on his road originated with the president, who recently rejected plans for the utilization of box cars for three camps and substituted therefor 80-ft. Pullman sleeping cars fitted with hot water heaters, running cold water and electric lights. Each of these sleepers is supplemented by two box cars, one at each end. In one of the box cars, one end is used for a tool compartment and the other for a locker and dressing room for the men. At the other end of the sleeper, the second box car is used as living quarters for the woman cook for the gang and her husband, who is also a member of the gang, and also for the storage of kitchen supplies.

R. D. Ransom (C. & N. W.) called attention to the value of housing men in modern equipment by reason of the fact that they can then be moved more promptly in an emergency. He urged that the cars be made fit for transportation as well as living purposes for this reason. H. H. Best (M. P.) stated that since he has housed members of his gangs in coaches properly equipped, he has found that his forces have become more stabilized and that the number of floaters has greatly decreased.

Programming Bridge, Building and Water Service Work

COMMITTEE REPORT

E. C. Neville
Chairman

WHEN IT IS considered that the railways of Canada and the United States have $1,680,000,000 invested in buildings, $2,500,000,000 in bridges, and $460,000,000 in water stations, some idea is obtained of the responsibilities of the officers who are in charge of these facilities. As a further indication of the magnitude of these railway facilities, $92,000,000 is spent annually for the maintenance of buildings and $90,000,000 for their enlargement and improvement and for new buildings; bridge maintenance costs in excess of $37,500,000 annually, and $47,000,000 is spent every year for the maintenance and operation of water stations, in addition to more than $7,000,000 for their enlargement and improvement and for new stations. It is evident, therefore, that the supervisory officers in these departments can do much toward effecting economies in their work by proper planning and by close adherence to these plans in the execution of the work which is assigned to them.

Calls for Careful Study

In preparing a program, it must be borne in mind that a careful study of conditions and requirements is necessary on the part of supervisory officers but the results are well worth the effort. One of the most important steps in the establishing of such a system is that the bridge and building supervisor should make careful notes throughout the year of such work as he considers should be done during the following year; then, during the annual fall inspection, a decision can be reached as to the work that is of the most importance and it can be placed on the program.

After listing all work in the order in which it should be performed, bills of the materials required should be prepared and placed opposite the respective jobs on the list, the estimated number of man-hours required, the date of starting and completion, and the estimated total cost of each job. Notations should also be made of the class and amount of equipment required.

In preparing the program care must be taken to insure an even distribution of the work over the entire year, in order that any project which will interfere with the movement of trains may be so placed on the list that it can be undertaken during the season of lightest traffic. Both bridge and building painting (exterior as well as interior) should be included in this program and so planned that all interior work may be done during the winter months, and the exterior work during the early spring and late fall, with the summer months set aside for the undisturbed painting of steel bridges.

Keep Small Jobs in Mind

The successful carrying out of a program depends to some extent on the manner in which it has been prepared. If, for instance, on any particular portion of the line a job of some size is scheduled for a certain time of the year, the minor jobs in close proximity should be scheduled so that they can be done while the gang is in that vicinity. Another important contribution to the successful operation of a yearly program system is the careful preparation of requisitions, submitting them far enough in advance of the date required to permit the purchasing and stores departments to secure the material in the regularly prescribed manner.

Notations should be made on requisitions of any substitutions of materials which may be made, as the stores department may have material on hand that will answer the purpose just as well and can be substituted, thus saving time and additional expense in filling requisitions. The date of required delivery should also be shown on the requisition and should correspond with the date of the starting of the work as shown on the program, so that the arrival of the material will coincide with the arrival of the gang.

Emergencies Will Interfere

Serious emergencies, such as fires, washouts, or wrecks, must of necessity be handled promptly regardless of programs, and, as they cannot be foreseen, it is impossible to make allowances for them in the preparation of a program. The fact, however, that a program does exist is an advantage even though the schedule has been disrupted by serious emergencies, as an effort will undoubtedly be put forth to make up for the time lost.

Where a gang is assigned to a definite territory, the foreman should be supplied with a copy of that portion of the program concerning his particular territory; this will give him an opportunity to plan his work ahead.

Labor-saving devices are expensive and they must consequently be kept employed to the fullest extent possible in order to get a fair return on the money invested. No better means of doing this can be conceived than through the medium of a well prepared program showing the jobs on which such equipment is to be used, and the date it is required.

From replies received to a questionnaire sent out to about 50 railroads it would seem that the majority of them have some method of listing their larger maintenance jobs in the order of their importance. One road, in particular, programs all of the maintenance work on a man-hour basis and is able to complete its pile driving program on the exact date scheduled, and its timber work only a fraction of a day behind schedule with a resultant saving in unit costs of pile driving of 15 per cent and in the cost of placing of timber of about 17 per cent.

Conclusions

The advantages of programming are as follows:

1. Costly equipment can be used to the best advantage with less idle time.
2. The purchasing and stores departments are enabled to provide material and make deliveries as required, without having to resort to unsatisfactory rush methods.
3. It tends toward closer estimating and better inspection.
4. It gives a better comparison of the worth of various forces, as a goal has been set for them to strive for, which tends to increase the quality and amount of work accomplished.
5. It avoids cross hauling of outfits, thus saving time.
6. It gives foremen an opportunity to plan and study their work in advance.
7. It has a tendency to stabilize employment and develop the morale of the forces.
8. It keeps officers in closer touch with the work and affords better control of expenditures.

While there are numerous other advantages, these should be sufficient to warrant the practice.

Committee: E. C. Neville, C. N., (chairman); H. H. Best, M. P.; H. C. Munson, C. M. St. P. & P.; W. A. Hutcheson, C. & O.; R. J. Black, P. M.; G. S. Crites, B. & O.; D. C. Barrett, C. & N. W.; J. P. Yates, Gulf Coast Lines; V. E. Engman, C. M. St. P. & P.; and A. L. McCloy, P. M.

Discussion

While the trend of the discussion of this report indicated that most of those present favored the programming of work, it was evident that they also felt that such a plan was surrounded with some difficulties. Among these was C. M. Burpee (D. & H.) who stated that a survey of three years' actual performance of one division of his road showed that 25 per cent of the time of the bridge and building forces was spent on appropriation work and 50 per cent on routine maintenance, leaving 25 per cent for work included in the programs. In contrast, H. C. Munson (C. M. St. P. & P.) stated that last year one crew on his division finished its season's program exactly on the day scheduled and another one day late. From this experience he contended that a schedule can be followed if one is determined to make it go.

C. D. Turley (I. C.) maintained that difficulty in following a program is no objection to the plan for so far as it can be followed it tends toward efficiency. He emphasized the fact that programming requires the closer inspection and better knowledge of one's territory, which facts in themselves contribute to better planning.

T. Turnbull (A. A.) referred to the advantage of a program from the standpoint of the stores department in assembling material in an orderly manner. Supplementing this thought Mr. Burpee stated that it had been possible to reduce the lumber stock 38 per cent in a single year on one division of his road following the inauguration of a program. In addition, the purchasing department was able to buy much of its material on a quarterly rather than an annual basis. T. E. O'Brien (D. & H.) added that on his division it had been possible to reduce the material stock from a normal average of $18,000 to $20,000 down to $4,000. He stated that the painting program of this road contemplated that all structures shall be painted every five years, or one-fifth each year. He added that they completed 92 per cent of their bridge program last year.

L. C. Prunty (U. P.) said that in one year he had saved 35 per cent by programming his work, which demonstrated the economy of this practice to his satisfaction.

Supply Exhibit

A FEATURE of the convention was the presentation of exhibits by some 51 manufacturers of materials and equipment employed in the construction and maintenance of railway bridges, buildings and water-service facilities. This exhibit, which consisted primarily of catalogues and other literature, was presented by the Bridge and Building Supply Men's Association, the officers of which were: President, W. D. Waugh, Detroit Graphite Company, St. Louis, Mo.; vice-president, I. B. Tanner, Nelson Water Service Company, Chicago; treasurer, B. J. Wilson, Pocket List of Railroad Officials, Chicago; secretary, W. H. Lawrence, Johns-Manville Sales Corporation, New York. At the annual meeting of this organization on Thursday morning, Mr. Tanner was elevated to the presidency, Mr. Lawrence was elected vice-president and Mr. Wilson was re-

elected treasurer. S. A. Baber of the High Grade Manufacturing Company, Cleveland, Ohio, was elected secretary. J. W. Shoop, Lehon Company, Chicago, and W. W. Patterson, Jr., of the W. W. Patterson Company, Pittsburgh, Pa., were elected directors for a three-year term to serve with E. G. Whitmore, De Vilbiss Company, Toledo, Ohio; B. S. Spaulding, Fairbanks, Morse & Co., Chicago; E. E. Kelly, Celotex Company, Chicago, and C. E. Roscoe, C. A. Dunham Company, Chicago, whose terms expire at succeeding conventions.

The companies participating in the exhibit and the names of their representatives are as follows:

Aluminum Company of America, Pittsburgh, Pa.; aluminum paint; conduit; aluminum shapes, nails, rivets and screws; literature on aluminum products; Carl E. Miller, A. B. Anderson and W. B. Roberts.

American Hoist and Derrick Company, St. Paul, Minn.; literature and photographs of locomotive pile drivers, derricks, crawler cranes, locomotive cranes, railroad and locomotive ditchers; Wm. M. Schoen, Miss H. M. Hoeller, S. M. Bryant and J. L. Prayter.

American Railway Hydrant & Valve Co., New York; hydrants and valves; W. Volkhardt.

American Rolling Mill Company, Middletown, Ohio; samples and literature on ingot iron; H. M. Arrick, R. C. Beam, W. W. Graham and R. Y. Barham.

American Valve and Meter Co., Cincinnati, Ohio.

The Barrett Company, New York; roofing, shingles, carbosota creosote oil, tarvia-lithic pavement and waterproofing; F. N. Nichols and J. E. Haynes.

Binks Manufacturing Company, Chicago; paint spraying equipment, literature; J. E. Schabo.

Carter Bloxonend Flooring Company, Kansas City, Mo.; samples of wood block flooring; literature and photographs; L. L. Bucklew and C. E. Emmert.

Celotex Company, Chicago; Celotex products and literature; E. E. Kelly, J. H. Bracken and D. J. Carmouche.

Chicago Bridge & Iron Works, Chicago; literature and photographs of steel water tanks.

Clyde Iron Works, Duluth, Minn.; literature and photographs of railway construction equipment; R. G. Luster.

Concrete Materials Corporation, Chicago; patch cement, waterproofing; E. C. Otte.

Curtin-Howe Corporation, New York; literature on Z M A wood preservative; F. S. Shinn and A. E. McDougall.

Dearborn Chemical Company, Chicago; literature; Charles F. Barham, Jr., Paul T. Payne and S. E. Moore.

Detroit Graphite Company, Detroit, Mich.; literature on paint; W. D. Waugh, L. F. Flanagan, A. B. Edge and Neil Wright.

The DeVilbiss Company, Toledo, Ohio; paint spray systems; E. G. Whitmore, J. W. Savage and M. M. Murphy.

Paul Dickinson, Inc., Chicago; caboose jacks, cast iron chimneys, roof ventilators, deck and roof drains and cast iron exhaust heads; A. J. Filkins, A. E. Engman and K. T. Batchelder.

Duff-Norton Manufacturing Company, Pittsburgh, Pa.; jacks; C. N. Thulin, Albert Roberts and E. E. Thulin.

C. A. Dunham & Co., Chicago; valves, traps, unit heaters, photographs of steam heating installations; C. E. Roscoe.

Fairbanks, Morse & Co., Chicago; F. M. Condit, C. H. Wilson, B. S. Spaulding, H. J. Smith, D. K. Lee, E. J. Coverdale, H. E. Vogel and H. L. Hilleary.

Fairmont Railway Motors, Inc., Fairmont, Minn.; Kenneth Cavins.

Federal Cement Tile Co., Chicago; cement roofing tile and cribbing literature; H. M. Butters.

Hastings Signal & Equipment Company, Boston, Mass.; telltales; R. W. Hastings and Harry H. Nayor.

High Grade Manufacturing Company, Cleveland, Ohio; literature and samples of fiber cement; S. A. Baber and J. N. Kinn.

Ingersoll-Rand Company, New York; literature on compressed air equipment for bridge and building work; G. W. Morrow and D. C. Peacock.

Ingot Iron Railway Products Company, Middletown, Ohio; corrugated culvert with protective coating; literature on drainage; T. Scott and E. T. Cross.

The Insulite Company, Minneapolis, Minn.; samples of insulite; Jack Frost and D. D. Grassick.

International Derrick & Equipment Co., Columbus, Ohio; section of standardized insulated metal building; C. Stein.

Johns-Manville Sales Corporation, New York; roofing and building materials, pipe and boiler insulation, waterproofing, industrial flooring and smoke jacks; W. H. Lawrence, A. C. Pickett and B. J. Queen.

Jones Paint Company, Rome, N. Y.; liquid and plastic roofing cement; A. de Wolfe Jones and L. V. Jones.

The Kaustine Company, Inc., Perry, N. Y.

The Lehon Company, Chicago; samples of roofing, waterproofing membrane, shingles, waterproofing and roof coatings, and asphalt emulsion; Tom Lehon, J. W. Shoop and H. A. Wolfe.

Lewis Asphalt Engineering Corporation, New York.

Chas. R. Long, Jr., Company, Louisville, Ky.; literature and panels on paint products; Chas. R. Long, Jr., Wiley B. Bryan, M. H. Oakes and K. E. Clarke.

Louisville Frog, Switch & Signal Co., Louisville, Ky.; reflector switch lamps and signs; F. W. Carter, J. S. Drillette and J. E. Butler.

Massey Concrete Products Company, Chicago; literature on reinforced concrete culvert pipe, cribbing and piling, also photographs; David A. Hultgren, J. A. Higgs and W. L. McDaniel.

The Midland Company, South Milwaukee, Wis.; door hangers; literature; R. A. Nourse.

Murdock Mfg. & Supply Co., Cincinnati, Ohio; railway water service boxes and air valves; J. C. Endebrock and J. C. Endebrock, Jr.

National Boiler Washing Co., Chicago; F. W. Gale.

National Lead Company, New York; literature on red and white lead; F. E. Dodge, Francis M. Hartley, Jr., and Prof. A. H. Sabin.

Nelson Water Service Co., Chicago; literature; John E. Tanner and I. B. Tanner.

Ohio Valley Rock Asphalt Co., Louisville, Ky.; J. B. Wilson and George W. Rapp.

W. W. Patterson Co., Pittsburgh, Pa., tackle blocks for wire cable and manila rope; W. W. Patterson, Jr.

Phelps Drake Co., Inc., Minneapolis, Minn.

Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa.; photographs and literature on steel water tanks and treating plants; A. B. Sanderson, Jr., J. L. Dailey, W. R. Workman and J. E. O'Leary.

Pittsburgh Plate Glass Company, Newark, N. J. (Paint and Varnish Division); paints, varnish and literature; C. S. Gush and F. A. McEvay.

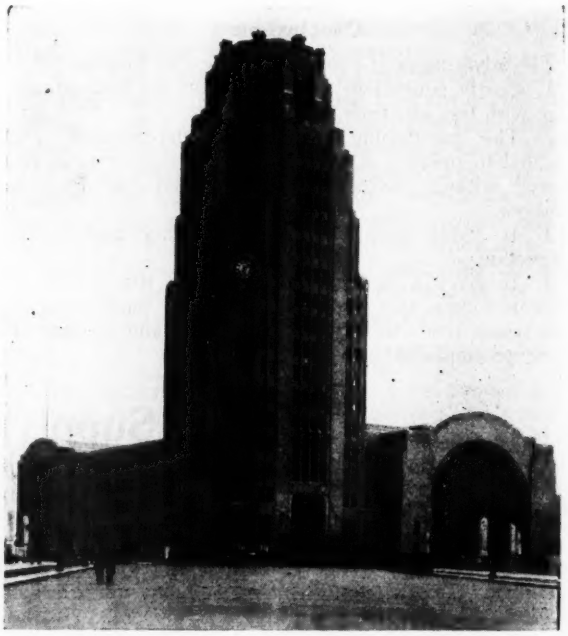
Pocket List of Railroad Officials, New York; copies of Pocket List of Railroad Officials; B. J. Wilson.

Railway Engineering and Maintenance, Chicago; copies of *Railway Age* and *Railway Engineering and Maintenance;* Elmer T. Howson, J. G. Little and F. C. Koch.

The Ruberoid Company, New York.

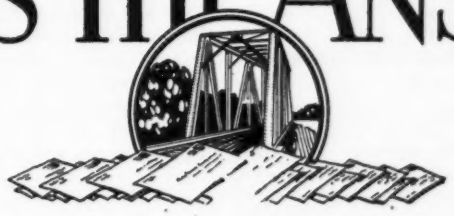
The Sherwin-Williams Company, Cleveland, Ohio; Arthur Larkins.

U. S. Wind Engine & Pump Company, Batavia, Ill.; literature on tanks, steel towers, water columns and tank fixtures; C. E. Ward.



The New Buffalo Station of the New York Central

WHAT'S THE ANSWER?



Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE JANUARY ISSUE

1. *When laying rail in the winter, how should the thermometer be used to insure that the correct expansion is being provided? Does this differ from the method that should be followed in the summer? If so, how?*

2. *What tool and supplementary equipment should be provided for pile-driver outfits?*

3. *What practical means, if any, can be employed to minimize the damage to frog points from the pounding of passing wheels?*

4. *Where it is necessary to open large doors in locomotive and car shops during cold weather, what means, if any, can be employed to minimize the fluctuations of temperature near these openings?*

5. *How many rails should be carried on an individual section? Where should they be kept? Should they be retained unused until needed, or should they be changed from time to time? If the latter, how often?*

6. *What practical means, if any, can be employed to prevent the freezing of hydrants during the winter?*

7. *When applying tie plates, what method should be used in lifting the rail to avoid injury to the men doing the work?*

8. *Is it necessary or desirable to waterproof the back surface of a retaining wall? Why? If so, how should it be done?*

Precurving Rails

Should rails be precurved? If so, what is the minimum curvature for various weights of rail for which this should be required?

Quotes American Railway Engineering Association

By J. R. WATT
General Roadmaster, Louisville & Nashville, Louisville, Ky.

At its twenty-fifth annual convention, the American Railway Engineering Association, after an extended discussion, adopted the following conclusion which was recommended by the Track committee: "Except on very sharp curves, much sharper than usually found in main line curves, rail need not be curved before laying." I am in thorough accord with this conclusion as a result of many years' experience in mountain territory. It would seem that the practice, which was formerly followed extensively, is being discontinued gradually.

Desirable for all Degrees of Curvature

By W. C. ROURK
Section Foreman, Missouri-Kansas-Texas, Waskom, Tex.

As a result of long experience in laying and maintaining both straight and precurved rails, I am convinced that it is desirable to precurve all rails that are to be laid on curved track. As the weight of the rail or the degree of curvature increases, this becomes a practical necessity, if good line and gage are to be maintained without excessive attention.

A curve upon which precurved rail has been applied will retain its line and gage much better than if laid with straight rail. If laid with straight rail the joints on the high rail work outward, causing wide gage and sharp kinks at the joint. On the inside of the curve, the joints show a more marked tendency to kink in toward the center, thus making the gage tight. If the rails are properly precurved, the joints do not kink and the remainder of the line is more easily maintained. The cost of precurving is relatively small and is more than offset by the lessened maintenance costs.

As the rail section increases in size this tendency of the joints to kink is accentuated, and I believe it is a mistake to lay any main line curve above one degree with straight rail. It has been my observation that rail which has not been precurved results in more throat-cut spikes than rail that has been precurved. I attribute this to the constant effort of the rail to spring back to the straight position, particularly under the action of moving trains.

Precurving Rails Makes Lining Difficult

By ENGINEER MAINTENANCE OF WAY

Frequently more harm is done by precurving the rails than can be offset by the benefits obtained. For curves up to eight degrees, it is my experience that there is no necessity for precurving the outer rail regardless of the weight, and I am inclined to believe this may be true for somewhat sharper curves. Usually it will be found that when rails on curves, say above three degrees, do not conform to the alinement, it is because the joints of the low rail show a tendency to kick inward.

Under such circumstances I have secured excellent results from setting the rail bender exactly at the ends of the rails and giving them a slight kink. Using a three-foot straight edge, the mid ordinate should be about 1/16 in. This should be done, however, only for the rails that are to be laid on the inside of curves of 3 deg. or sharper. If these rails are treated in this

manner, the joints will show no tendency to kick out of line and the rails on both sides of the track will possess "life" when surfacing and lining is being done, in contrast with the "dead set" which always results from precurving.

Advocates Precurving for Mountain Grades

By J. J. Hess
General Roadmaster, Great Northern, Seattle, Wash.

From my observation, it is my opinion that, for curves of 3 deg. and over, on heavy mountain grades, where the speed of many of the trains is reduced sharply in the uphill movement, it is important that the rails be precurved, since the inner rail shows a marked tendency to straighten out. It is possible that this tendency will not be so marked with the present heavier sections and longer rails, and this is likely to be true on lighter grades where a more uniform and higher speed can be maintained. We follow the practice of putting a little more curvature in the quarters than in other portions of the rail to minimize the tendency of the joints to kink.

Should Precurve for Curves Above Four Degrees

By R. H. Gilkey
Division Engineer, Central of Georgia, Savannah, Ga.

Where the rail to be laid is of 75-lb. or heavier section, it should be precurved for all degrees of curvature including 4 deg. and sharper. In doing this precurving, care should be exercised to obtain a uniform rate of curvature throughout the full length of the rail. If the rail is 33 ft. long, the mid ordinate for a 3 deg. curve should be 1 in.; this increases to 1⅛ in. for a 4 deg. curve.

Preventing Damage to Valves

What precautions, if any, should be observed in the operation of valves in water lines to prevent injury to them?

Avoid Excessive Tightening

By R. H. Gilkey
Division Engineer, Central of Georgia, Savannah, Ga.

Injuries to valves generally result from excessive tightening. If a valve leaks from any cause, the washer should be renewed or the seat should be reground. A leak that is allowed to continue will cut the seat and will, therefore, grow worse progressively. Valves should not be forced shut nor screwed tight, and no more power should be used in closing them than just sufficient to seat the valve. Excessive tightening breaks down the valve seat or cuts the washer and causes a greater amount of leakage.

Good Judgment and Common Sense Are Required

By L. L. Tallyn
Division Engineer, Delaware, Lackawanna & Western, Scranton, Pa.

The best answer to this question is that good judgment and common sense should be used in the operation of valves as with other forms of equipment. In the case of valves that are not used frequently, such as main-line shut-offs, it is good practice to operate them at regular intervals to prevent the parts from becoming incrusted, since this condition is likely to prevent the valve from closing tightly. Undue force is often used when closing a valve, with the result that the parts are strained and damaged. It is also good practice, when shutting off a gate valve, to have the stem turned back slightly after the gate has been set tight, in order to release a certain amount of the strain from the bonnet of the valve.

It has been my experience that more valves are injured, and sometimes completely ruined, when the pipe installations are made than later under normal service conditions. For this reason special care should be exercised while the pipe is being installed to make sure that every section is clean before it is placed in the line. Furthermore, equal precaution should be taken to prevent foreign substances from entering the line after the pipe is in place. It is also good practice to flush the line thoroughly before it is placed in service to wash out any dirt or other matter which may have been overlooked while the line was being assembled. The flushing should be done before any of the valves are closed.

Care Is Required in Installation as Well as in Operation

By J. H. Davidson
Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

Since valves are the means of controlling the flow of water in systems of pipe lines, it is essential that they should be selected with care, properly installed, well maintained and correctly operated. In the first place, only valves of dependable quality should be used, and they should be heavy enough to permit reseating several times. This cannot be done with inferior valves, which seldom have sufficient stock to permit repairs.

Valves should be installed with care. Quite often trouble is encountered in the operation of valves, which can be traced to lack of care in making the installation. Every valve should be examined carefully before being placed in the line to insure that no foreign matter is left in it. Even a small bit of scale, iron filings or other metal, is capable of doing considerable damage to a valve seat. Equal care should be used to see that pipe threads are not cut long enough to permit the pipe to run up against the seat and ruin it. If a pipe compound is used, it should be applied to the thread on the pipe, rather than to the thread in the valve. This will keep it out of the interior of the valve where it might cause trouble.

In tightening bolts on flanged valves and bolts in bonnets, care should be exercised to tighten each bolt a little at a time, in order not to put undue strain on the body of the valve. In screwing a valve to a pipe, the wrench should not be placed on the end of the valve farthest from the pipe, as this may place undue strain on the valve and spring the seat. Lines should be thoroughly flushed out after construction to remove foreign matter.

If a valve is properly maintained and properly operated, it should last for years. Regular inspection should be made of all valves. Those which are not used frequently should be operated periodically to keep the seats and gates clear of deposits, and all valves should be painted, lubricated and repacked when necessary. When a valve leaks, the seat should be reground at once, before the damage becomes greater.

The sudden closing of valves in water lines, particularly those carrying high pressure, causes water hammer which is responsible for considerable damage to the lines. Such valves should be closed slowly enough to avoid this effect. If the rate of closing is uniform the maximum pressure in the pipe line will occur at the end of the movement, and this pressure will be approximately proportional to the length of the pipe, the speed of closing the valve and the velocity of the flow. If the valve is closed rapidly at first and more slowly at the

end of the movement, the water hammer will produce a lower maximum pressure.

Probably more valves are damaged by being forced than in any other way. The hand wheel on a valve is large enough to close it properly without resort to leverage. If a valve seats improperly it will leak and should be reseated. Putting a wrench or lever on the hand wheel of a valve to make it tight will damage the valve and the leak will become progressively worse until the valve is properly repaired.

Smoothing Track

How long a period should be allowed for smoothing the track after the tie renewals for the year have been completed? What details of track maintenance should be given particular attention at this time?

Depends on Track Conditions

By J. J. Hess
General Roadmaster, Great Northern, Seattle, Wash.

I have always found it to be good practice to renew ties in such a manner as to cause a minimum amount of disturbance to the track surface, both at the time the renewals are made and subsequent thereto. To do this it is necessary to complete every detail of the work by the close of the day, including the lining of the track and replacing and dressing the ballast. Furthermore, the renewal of too many ties at any one place should be avoided wherever possible.

If the practice is followed of starting the tie renewals as early in the spring as climatic conditions will permit and continuing this work rapidly and consistently until the year's allotment has been inserted, ample time will be afforded for smoothing the line and surface before winter sets in. As soon as the tie renewals are out of the way, the gang should start at one end of the section its work of smoothing the track and continue progressively with as few interruptions as possible until it is completed. Among the many advantages of this method, one is that the work is systematized, thus affording an easy check on the progress that is being made.

Track conditions are the governing factor in determining how much time will be required for this part of the season's work, but if the precautions mentioned are taken to disturb the track as little as possible during the period of tie renewals, a minimum time will be necessary to get it into excellent shape for the winter.

About Two Months Are Required for Satisfactory Work

By W. E. Connell
Roadmaster, Atchison, Topeka & Santa Fe, Pampa, Tex.

In general, the work of renewing ties extends into the early fall. On roads that are located in sections that do not have open winters, the summer force should be continued until the track is smoothed, regardless of the time required to do this. If the season's work has been carried out in a well organized manner and under normal condition, however, the tie renewals should be completed in ample time to allow the track to be smoothed without extra force or undue haste. On the ordinary section, it should require about two months to make conditions satisfactory for carrying the track through the winter, including all work incidental to this primary operation.

This part of the season's work should be programmed as definitely as any other part and should be carried out in conjunction with the tightening of bolts, adjusting rail anchors, such dressing of ballast as may be necessary, and track drainage. During the latter part of this period much of the right-of-way can be burned. If the work is properly co-ordinated, when the gang has passed over the section the essentials of good track will have been taken care of, and ample time will remain for other work not connected directly with track maintenance. These include burning the remainder of the right-of-way, cleaning out culverts, setting fence posts, erecting snow fences and a certain amount of surface ditching, all of which should be done before freezing weather or snow.

With these jobs out of the way, the time during the early winter can be spent in the final cleaning of the right-of-way, in regaging on curves and at switches, in changing rails, in stringing fence wire, and other necessary but disconnected work.

Inspecting Turntables

How often should a turntable be inspected? What details should be given attention?

Should Average Four Times a Year

By J. E. Bernhart
Bridge Engineer, Chicago & Eastern Illinois, Chicago

The interval between inspections of turntables may be varied to some extent to accord with the amount of service performed by the table. I think, however, that the average turntable should be inspected by a representative of the bridge and building department not less than four times a year. I consider that the most important items to observe are lubrication, wear of machine parts and clearances. In addition, the inspector should observe the condition of running rails, the timber deck, the relation as to elevation and alinement of the running rails to the rails in approach tracks, the condition and profile of the circle rail, the play, if any, in the bearings of the truck wheels, the radial alinement of truck wheels, the cleanliness of the structural steel and the condition of the masonry.

I place lubrication first because lack of attention to this item accounts for a great deal of maintenance expense. I have found that added attention to the lubrication of turntables can be brought about if a lubrication chart is placed in the operator's cab or in the enginehouse. On this chart space is provided for the date each item of lubrication is attended to and the signature of the party applying the lubricant. It is advisable to require the lubrication of all moving parts, except the center, at least once a week. Roller bearings or disc centers with bearing surfaces running in oil should have a change of oil every three months and this change should be made at the time of inspection.

The inspector should examine carefully all pinions and gears and all bearings and note excessive wear. He should make such examination with the table stationary and then make similar observations while the table is being rotated so that he can detect wear and observe the clearance between the moving parts and their frames. The amount the structure will drift after the power is shut off is some indication of the condition of the center and truck bearings and observation of this will assist in locating bearings which are not receiving proper lubrication.

The clearance between the rotating table and the circle wall, approach track rails and similar objects should be given attention. It is important that the top of the running rails on the table be level with the top

of the rails in approach tracks when the end trucks are bearing on the circle rail. Failure to insure this condition may result in considerable damage to motive power as well as to the turntable.

Attention should be directed to the drainage of the turntable pit to make certain it is open and will function to prevent the center from becoming covered with water. Flooding of oil-filled centers will shorten materially the life of this expensive part of the structure.

Where outside tractors are used for propelling turntables, it is advisable to determine whether they are properly counterweighted. Slippage of tractor wheels results in rapid wear on the circle rail. Similarly truck wheels, the axles of which are not truly radial, will result in wear on the circle rail and thrust bearings. The inspector can detect bad alinement of these axles by observing the movement of the wheels on the circle rail while the table is rotating.

Depends on Type and Service Performed

By F. H. Cramer
Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

The frequency with which a turntable should be inspected depends entirely on the type, length, engine capacity, type of center bearing and the terminal facilities. At the important terminals, where all types of locomotives must be turned, especially the heavy type, the center bearing and the end-carriage bearings should be inspected at least twice a year by a competent engineer who understands fully the design, its operation either by air or electricity and all other machinery parts required for operation. At other terminal points, where the service is limited, the inspection should be made at least once a year.

When arrangements are made for the inspection, the turntable should be raised sufficiently to allow all bearing parts to be removed. These parts should then be cleaned thoroughly, so that the inspector can examine each part for mechanical wear, cracks or broken parts. In replacing the parts of the center, care must be taken to see that they are clean and well oiled or greased.

In the roller-type center, attention should be given to the top and bottom bearing discs, rollers and confining rings. The bearing surfaces of the discs may become very rough and wear materially as a result of ingress of dirt or by water flooding out the oil. The conical rollers should always have a smooth surface.

The confining rings and bolts are the important factors in holding the rollers in their proper alinement, and often these are found worn or cracked. The brass or bronze washers used as spacers between rings and rollers sometimes wear very badly and must be watched. If not, the rollers will get out of adjustment and cause excessive wear on the top and bottom bearing discs.

On the disc-type center the wearing surfaces of the top bronze center and bottom discs need the most attention. The oil grooves should always be kept cleaned so that they will take their full amount of oil to lubricate the revolving surfaces properly. The disc-type bearings lubricated by means of a force oil pump, if the turntable is power driven, can use a very heavy valve oil up to extreme freezing weather. During the extreme weather, a light cylinder oil can be used.

End-carriage bearings usually consist of four wheels, shafts and bearing boxes. It should be noted whether the fastenings on the boxes are tight, the shafts well oiled and the wheels in their proper radial alinement. It is important that these parts are properly tended to; if they are allowed to become loose and excessively worn, this condition will eventually result in delays to power and large maintenance expense. All maintenance, including circle tracks and tractors, should be observed by the inspector. The circle rail often causes trouble if it is not kept to a true circle, properly fastened and level, which is an important factor in quick operation and less power consumption.

The running rails at the end of the table, together with the guard rail system or other devices, should be maintained in good condition to avoid derailments. All parts on the tractor should be looked over frequently, as this part is the main power factor in keeping the table in continuous operation.

The mechanical department officer at each terminal should be in charge of the operation of the table and should be furnished definite and detailed instructions in regard to oiling, greasing, prevention of spilling water on steel and deck, the care to be used in the operation of the table, frequent inspection of the oiling system, movable parts and the power furnished for operating.

Wood-Block and Brick Floors

What are the relative merits of cement grout and an asphalt filler for wood-block and brick floors?

Prefers the Asphalt Filler

By A. T. Hawk
Architect, Chicago, Rock Island & Pacific, Chicago.

Our present practice does not include the use of brick floors for the reason that we find concrete is more satisfactory. I presume that the wood blocks to which the question refers are creosoted wood blocks. I have never attempted to fill wood-block floors with cement grout and cannot, therefore, discuss the comparative merits of the two fillers for such floors from actual experience. In my opinion, however, based on observations of its use elsewhere, cement grout does not seem to be a proper material to use with this type of floor.

In drying out, cement grout has a tendency to shrink in volume and, since the wood undoubtedly will absorb considerable of the contained water, it is likely that the grout will disintegrate to some extent and thus lose its effectiveness. Asphalt fillers, on the other hand, seem to have all of the advantages and none of the disadvantages of cement in this application. The asphalt filler may cost slightly more, but will do the work much better and will probably last longer.

In my experience, in grouting brick floors there always seems to be a tendency on the part of the brick to break up into slabs as a result of expansion and contraction. While this may occur to some extent if the filler is an asphalt compound, the trouble is not so noticeable and the floor gradually assumes its original state without requiring any special attention.

Asphalt Fillers Are More Satisfactory

By Engineer of Buildings

While cement grout can be used under some conditions to provide a satisfactory filler for brick floors, there are no conditions under which it is satisfactory for creosoted wood-block floors. If the brick is laid where temperature conditions are practically uniform, there will be little or no movement of the brick in expansion and contraction, so that the cement-grout filler tends to give a high degree of stability to the brick. If, on the other hand, temperature changes pass through a wide range, because of the bond between the filler and the brick, the brick expands or contracts en masse, with the result that the floor is likely to break up in slabs

and show wide cracks during periods of low temperature or tend to heave at high temperatures. An asphalt filler, however, because of its elasticity, permits the expansion or contraction to take place independently in the individual bricks, so that there is no abnormal movement of the floor as a whole.

Expansion or contraction in wood-block floors occurs because of an increase or decrease in the moisture content of the wood and to a small degree follows the moisture content of the air. For this reason, wood blocks should be laid relatively loose and the spaces between the adjacent blocks should be completely filled with an asphaltic compound applied as hot as practicable. If this is done, no trouble will be experienced from movements due to expansion and contraction.

The writer recalls his first experience with a wood-block floor filled with cement grout. The floor was laid fairly tight and served a 40-stall enginehouse where it was the practice to clean the floor by flushing it periodically. Considerable trouble with heaving was experienced as a result of this practice. To overcome the trouble, narrow sections were cut from a line of blocks at intervals to provide room for expansion, and the openings were packed lightly with oakum. Although not entirely satisfactory, this expedient worked fairly well until, on one occasion, the boiler-washing plant became inoperative for several hours. During this period the boiler-washout men drained the hot water from the locomotive boilers onto the floor, with the result that the floor was completely broken up adjacent to the stalls where this was done. After this, the floor over the entire house was relaid as already described and, although it is now nearly 20 years old, it has given no further trouble from this cause.

Wear on Motor Car Tires

What practical method, if any, can be employed to determine the amount of wear on track motor car tires?

This Is An Important Thing to Know

By C. R. KNOWLES
Superintendent Water Service, Illinois Central, Chicago

Comparatively few men who commonly use track motor cars concern themselves very much about the amount of wear on the wheels of the cars. Yet it is extremely important that the wear on the tires of such cars be checked carefully from time to time, since the safety of the car and its occupants depends to a large degree on the condition of the wheels and tires.

Wear on tires of track motor cars takes place on both the tread and the face of the flange. If the wheel is in correct gage and alinement, the wear on the tread and the flange should be approximately equal. Unfortunately, however, the wheels are rarely in perfect alinement, and many of them are not properly gaged, with the result that where this condition exists there is invariably a great deal more wear on the flange than on the tread. This has a tendency to increase the probability of derailment and, in numerous instances, flanges have worn so badly as to come off and cause the derailment of the car.

Unusual wear on wheels should be readily detected by an experienced eye. It is apparent, however, from the condition of many wheels in service and the frequent accidents which result from worn wheels, that the average motor car operator either does not appreciate the importance of checking the wear or is unable to do so without a gage. A standard tire gage is, obviously, the only accurate and reliable method by which the actual amount of wear can be determined, and such a gage should be used in every case where there is any doubt about the condition of the wheel.

Unfortunately, however, there is a certain lack of uniformity in the contour of the treads and flanges of motor car wheels, particularly of the flanges. For this reason, the use of a gage by an inexperienced person is likely to lead to confusion, since some treads are straight, while others taper, and the height of flanges varies. This variation in the contour can be overcome in a very short time, however, through the general use of the standard wheel tread and flange for 16-in. and 20-in. wheels, which was adopted recently by the American Railway Engineering Association, and which was described on page 216 of the May issue of *Railway Engineering and Maintenance*.

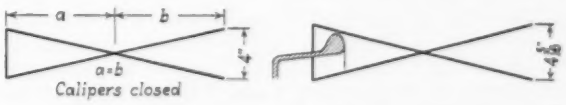
Pending the general adoption of this standard, the detection of wear on tires and flanges will require either a selected number of gages to fit each particular type of wheel in service, or frequent, careful inspection of the wheels by some one competent to detect unusual wear without the aid of a gage.

Home-Made Calipers Are Suggested

By E. L. MILES
Assistant Supervisor Signals, New York Central, Elkhart, Ind.

Owing to the frequent accidents which occur as a result of worn wheels on track motor cars, it is becoming increasingly important, particularly in view of the large expansion in the use of such cars by the railways, to check the condition of the tires frequently to insure that they are safe for further service. If all wheels were the same diameter and if the contours of the treads and flanges were standard, this could be accomplished easily by the use of a standard wheel gage. As a matter of fact, however, there seems to be no such uniformity in the contour of the wheels made by different manufacturers, nor of the wheels on the different sizes of cars made by certain manufacturers.

Since the average man in the field is seldom, if ever, equipped with wheel gages, he must develop some other means of determining the wear, and some form of



A Sketch of the Home-Made Calipers

calipers would seem to offer the best solution of this problem. The ordinary form of calipers cannot be used for this purpose, since they must be opened in order to get them over the rim of the wheel flanges. The accompanying sketch shows a pair of home-made calipers which can be made by any good mechanic, and which will give very satisfactory results.

To determine the thickness of the tire at any point, first close the calipers and measure the distance between the extension arms. Then apply the gaging end to the tire at the point to be tested and again measure the distance between the extension arms. The difference between these two measurements is the thickness of the tire. As an example, if the first measurement is 4 in. and the second 4 5/16 in., the thickness of the tire will be 5/16 in.

In making the instrument it is important that the arms shall be symmetrical around the pivot, that they

be of sufficient length to insure that they will open wide enough to go over the wheel flange and that there be no lost motion in the pivot.

Jacking Cast Iron Pipe

Can heavy cast iron pipe be jacked through embankments? If so, how? Which type of jack, screw or hydraulic, is best suited for this purpose?

It Can Be Done Without Difficulty

By R. H. GILKEY
Division Engineer, Central of Georgia, Savannah, Ga.

Heavy cast iron pipe can be jacked through embankments with comparative ease. To do this a trench is cut of sufficient length to accommodate one length of pipe beyond the working face of the embankment. At the far end of this trench jacking timbers are installed and a timber bed is placed in the bottom of the trench to support the section of pipe until it enters the embankment and to allow it to slide easily.

To jack any section, the pipe is lowered into the trench and the jacks are placed between it and the jacking timbers. These timbers should be back far enough to allow working space around the pipe before the jacking begins.

As the jacking proceeds and the pipe advances, a laborer works inside the forward end, cutting the earth away from this end and disposing of it through the open end. If the diameter of the pipe will allow, this disposition can be made by means of wheelbarrows.

Screw jacks are most satisfactory in this operation, since they are simpler to operate and do not get out of order as readily as hydraulic jacks. Two jacks should be used in order to minimize the tendency of the pipe to get out of line.

It Is a Relatively Simple Operation

By L. G. BYRD
Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

The jacking of cast iron pipe through embankments is a relatively simple matter, provided the necessary preparations have been made. If the preparatory work is done properly, the cost will be low, the time involved in doing the work will be shortened, and the results will be perfectly satisfactory. It should be emphasized, however, that there are certain features of the work which must be given constant and careful attention during its progress.

In the first place a trench should be cut in the embankment as close to the track as practical to minimize the amount of pipe that must be forced through the embankment. Jacking timbers, sufficient to resist without movement the maximum effort required from the jacks, should be installed at the outer end of the trench, and guide timbers should be placed on the bottom to support the pipe until it enters the embankment.

At the forward end of the first section, a supporting block should be fastened, of sufficient thickness to hold the forward end of this section to the same level or grade as the following sections, the forward ends of which are supported by the bell of the adjacent pipe. As the pipe advances, the earth is excavated ahead of the forward end. I have found that a small car body, detachable from a suitable frame which is supported on ordinary truck wheels, provides the most satisfactory means of disposing of the excavation for pipes 36 in. and 40 in. in diameter, and sometimes for larger sizes. Two of these bodies are used so that one can always be kept at the head end of the pipe for continuous loading. The truck can easily be moved back and forth by means of a ¾ in. rope attached to each end.

Transverse trenches, about 4 in. deep, spaced about 6 ft. apart, should be cut to provide for the disposition of such earth as is rolled up by the bell of the pipe. This detail will materially reduce the power required in jacking the pipe. If lock pipe is used, an additional cross-trench, located at the end of the guide timbers, near the forward end of the jacking trench, will facilitate the use of two or three turns of Manila rope for locking the pipe before jacking is started.

Only four men are required for 6 ft. pipe sections up to 36 in. in diameter. As a rule such a gang consists of one carpenter and three laborers. As the size or length of the pipe increases, more men are needed, principally for handling the pipe into the trench. I have been able to install pipe in the manner described at an approximate average cost of $2 a lineal foot.

My experience indicates that screw jacks of about 30-tons capacity are most suitable for this work. Installations of this character should be made at the height of the dry season wherever possible. If this is not practicable, it is often necessary to make more or less elaborate provisions for handling the drainage during the progress of the work, particularly if the project involves the replacement of a culvert already in service. In every case it is desirable to start the work on the upstream side of the embankment, as there is likelihood that otherwise the water will find a passage under the culvert.

Inspecting Switches

By whom should the inspection of switches be made and how often? What details should be given attention in making the inspection?

Supervisors, Foremen and Track Walkers Should Inspect

By W. H. SPARKS
Inspector of Track, Chesapeake & Ohio, Russell, Ky.

In my opinion the supervisor, section foreman and track walker should make regular inspection of all switches under their respective jurisdictions and each of them should be held equally responsible for the results of his inspection. Admittedly the switch constitutes the weakest part of the track structure, so that the importance of constant and watchful attention is apparent. For this reason every man, whether he be track walker or supervisor, who has any jurisdiction over the track, also has a definite responsibility for knowing that the switches are maintained to the proper standard.

It is my observation that in recent years, despite the increased weight of rail and sturdier switch construction, the increase in traffic, the heavier locomotives and cars and the higher train speeds have combined to cause more rapid wear on bolts, other fittings and the ties than occurred formerly. The increase in the number of wheels and the greater wheel loads tend to accelerate the wear on stock rails, switch points and frogs. One result of this is found in the tendency of the flowing metal from the stock rail to force the switch point away from this rail, thus creating a cause of derailment unless given close attention.

All of these items should be noted carefully in making an inspection of a switch. The gage should be tested; it should be noted whether the guard rail is in place and properly secured; any loose bolts should be tightened and all cotter keys examined and replaced, if missing. The same attention should be given to frogs.

Frog bolts should be tightened, if loose; wing rail bolts should be tested and the proper tension applied to the springs of spring frogs.

From my experience, it is my belief that every switch should be examined daily by the track walker and a report made to the foreman of any defects he is unable to correct. The foreman should make a careful inspection at least once a week, making a written report to the supervisor for every switch. The supervisor should examine every switch not less frequently than once every 60 days and report the result to the division engineer.

Every Detail Should Be Given Attention

By Roy Hahn

Clerk to Master Carpenter, Seaboard Air Line, Tampa, Fla.

Switches should be inspected weekly by the section foreman and monthly by the roadmaster or supervisor, each making a careful record of the inspection in which all defects that were discovered should be noted. All working parts should be examined carefully, and their adjustment tested to insure that they are working properly and fit correctly, and that they do not show signs of wear or deterioration which would unfit them for service.

The surface and line and the condition of the ties through the turnout should be noted. The gage should be tested and all bolts in the working parts should be examined to insure that they are equipped with cotter keys. Missing cotter keys should be replaced at this time. The condition of the frog should be noted, particularly as to wear and for loose bolts and rivets. The guard rails should be examined to insure that they are in proper condition with respect to flangeway and gage and that they are properly secured. The operation and condition of the switch stand should be tested carefully to insure correct throw and proper fit of the points against stock and running rails.

Switches Should Be Examined for Adjustment and Gage

By G. Stafford

Section Foreman, Canadian National, Rosebud, Alta.

Since the responsibility for the proper operation and efficient maintenance of turnouts rests primarily upon the track foreman, it should be his duty to make periodic and systematic inspections. Neither this responsibility nor this duty should be delegated to a subordinate. Daily inspection should be made of all main track switches. The frequency with which turnouts leading from secondary track should be inspected will depend upon the volume of traffic through them, but at least a bi-weekly inspection should be required. These inspections should be thorough and systematic and a record kept of all defects found and the action taken to correct them.

The most critical detail is the adjustment of the switch point against the stock and running rails. Correct gage and first class line and surface will do much to eliminate back lash and insure accurate adjustment. Constant vigilance must be exercised if the rails tend to creep, as the points may be crowded ahead enough to affect the adjustment or jam the rods and bridles against the switch ties.

The inspection should include a careful examination of the switch rods and connections to insure that they have no lost motion and that they move together with sufficient accuracy so that the horizontal distance between them is preserved. The stops which provide lateral support to the point under the thrust of traffic should also receive attention. If the stops are not functioning properly from any cause, there may be undue flexure from the lateral pressure of the wheel flanges which will cause the rail to bend enough to get a permanent set at some point where the section is reduced by planing. This may result in springing the point a sufficient amount to admit a worn flange, thus causing a derailment. The space between the points and the running rails should be examined for ballast or debris that might prevent an accurate fit of the points against these rails.

Finally, the switch stand and connecting rod should be gone over, noting in particular whether bolts or bolt holes are worn, whether cotter pins are in place, and the condition of the fastenings which hold the stand to the headblock. It might be mentioned that whoever makes a switch inspection should have a thorough knowledge of the details of the mechanical construction and the operation of the stand as well as of the other moving parts.

Switches Should Throw Easily and Have No Lost Motion

By Engineer Maintenance of Way

Switches should be checked periodically by both foremen and supervisors. The foreman has a direct responsibility for the condition of his switches and the safety of traffic over them. Many foremen, however, have so few switches that they never become expert in switch work. For this reason, while I do not advocate relieving the foreman of any responsibility in this matter, I do believe that supervisors have equal responsibility and should give the same careful attention to the condition of the switches as they require of their foremen. Manifestly, however, a supervisor cannot inspect all the switches on his territory as often as the foreman can inspect the switches on his section. The more important items to be checked when inspecting a switch include:

1. The fit of the points to the stock and running rail. Make certain that it is not a false fit caused by flowing metal. If the metal is flowing, the rail should be removed or the bead removed by grinding.
2. Switch stands should be fastened securely to the headblocks by means of bolts or spikes. Bolts provide the safer method and reduce maintenance costs.
3. Determine whether there is any back lash, or lost motion, in the connections. Connecting pins or bolts should be provided with cotter keys to insure that they will be held in place.
4. Switch locks and lamps should be examined to determine whether they are functioning properly and switch targets should be observed for adjustment.
5. Switch points and their operating parts generally are given the most attention, and they are important, but foremen frequently overlook the important part that the frog plays in the assembly of a turnout, and the danger which may attend even a little neglect of this part of the installation. This is particularly true of spring frogs. The fact that a spring frog shows little or no rail wear often induces only a cursory examination during the inspection.

Spring frogs are designed to provide a better riding condition through the turnout, but there is an element of danger in their use owing to the fact that it is practically impossible to prevent the wing rails of the present style of frogs from being raised above the true surface of the track by snow, ice or sand during storms. This can happen only when the rivets or bolts in the hold-down become loose. Yet it is really surprising how many of them become loose, and such frogs should be examined carefully for these defects.

6. Both frogs and switch points should be checked carefully for gage. If the gage at the frog is incorrect it should be corrected at once, and, if due to creeping rail, the rail should be driven back and anchored. Not infrequently, the heel of a spring frog will show wide gage while the gage at the point is tight.

7. Foremen frequently tighten guard rails to the running rail without first checking the gage. If the gage is wide, this results in damage to the frog, owing to the fact that the gage of the guard rail is also wide, causing the back of the wheel flanges to strike a hard lateral blow against the wing of the frog, resulting in wear, and loose bolts and rivets. An indication of this defect is a bright spot on the running surface of the rail opposite the frog, which is more easily discernible if the rail is wet. Correct gage will eliminate this side slipping of the wheels and its resulting damage.

8. Another detail which should be given attention is the ease with which the switch can be thrown. While the points should make a snug fit, it is not necessary to adjust the parts so that more than ordinary effort is required to throw it. If the switch is adjusted so that the points make a tight fit, additional but entirely unnecessary trouble may be experienced during snow storms.

Should Be Inspected Every Day

By J. J. Hess
General Roadmaster, Great Northern, Seattle, Wash.

We make it a point to have an inspection of all switches made once every day by the section foreman or by the most competent man in his gang, provided he has men qualified by training and experience for such work. Our instructions are explicit that, in making such inspection, the switch shall be thrown to determine whether the points fit snugly against the running rail when thrown for the siding and that a proper fit is obtained between the point and the stock rail when in normal position for main track movements. We do not permit switches to be thrown, however, except by the foreman in charge and then only for test purposes or for section cars under load. Inspections made by members of the gang do not include the opening of the switch and for this reason the foreman is himself required to make periodic inspections.

The necessity of knowing that the switch is locked before leaving and of seeing that all cotter keys are in place is impressed upon every man who is allowed to handle the switches. The man who makes the inspection is required to note whether the slide plates supporting switch points and spring frogs are oiled, whether bolts are tight and that guard rails are properly placed and secured. If such defects are found they must be corrected before he leaves.

The Inspection Should Be Thorough and Systematic

By W. E. Connell
Roadmaster, Atchison, Topeka & Santa Fe, Pampa, Tex.

It should be the duty of section and yard foremen to observe and inspect their switches as often as practicable, but they should also make a systematic inspection about twice a week. When making these inspections, the condition of the ties comes first in order, since poor ties make it impossible to hold the turnout in either surface, alinement or gage, the gage generally giving most trouble where the ties are poor. This inspection should begin at the headblocks and should include the method of and condition of the fastening of the switch stand to the headblocks, to insure that there is no lost motion from this cause when the switch is thrown.

After the ties are inspected, the stock rail should be examined to make certain that it is bent properly so as hide the point and to prevent a lurch of the passing wheels. The throw of the stand should then be tested and the fit of the points noted. At the same time, the Pitman and headrod connections should be watched to detect worn bolts or elongated bolt holes and to insure that all cotter pins are in place.

The gage should be checked from a point eight feet ahead of the points to the heel of the point. The switch points should be examined for wear and bluntness and the cause of bluntness or undue wear determined. The switch plates should be examined for wear and uniform bearing. Frogs and guard rails should be checked with respect to gage, flangeway, fit of all parts and for loose bolts and rivets. If excessive wear is occurring, its cause should be noted. The remainder of the turnout should be tested for gage and observation made of the condition of the line and surface.

It is good practice to observe a switch during the passage of trains, since there are often movements of the parts under traffic which influence the amount of wear or disturb adjustments and which frequently cannot be detected during the ordinary surface inspection. A corduroy switch, or one which does not have a uniform bearing, induces side thrusts during the passage of the rapidly moving wheels and, obviously, results in excessive wear on certain parts of the assembly. If this condition exists, the ties should be tamped immediately to give a uniform bearing.

It should be the duty of the roadmaster or supervisor to make a similar inspection periodically and, when practicable he should insist that the foreman be present. Both the foreman and the supervisor should keep records of these inspections and report the results to their superiors. All defects should be corrected immediately and these corrections should also be noted in the reports.

There Are Many Details That Require Attention

By R. H. Gilkey
Division Engineer, Central of Georgia, Savannah, Ga.

Since a switch forms the weakest link in the track structure, it should be given preferred attention. Section foremen should be required to inspect all switches at least once a week. On this road this is done on Saturday. The supervisor should make a detailed inspection once a month, but should also examine switches from time to time as his other duties permit, and forward to the division engineer monthly a report covering every switch on his territory.

The following points are particularly important and should be fully covered in the report:

1. Is there a cotter key in the foot of the crank?
2. Fit of point against stock and running rails.
3. Actual throw at point of switch.
4. Distance between stock rail and heel of switch.
5. Are the lugs and bolts loose or tight?
6. Are cotter pins in all switch bolts?
7. Number and condition of foot guards.
8. Condition of case on spring frogs—adjustment of springs.
9. Fit of wing rail of spring frogs.
10. Are all frog bolts in place? Are all tight?
11. Width of flangeway of guard rail.
12. Date inspected.

The report should contain a space for noting the action taken on such defects as are found. Any defects should be corrected immediately, but if this has not been done the matter should be followed up systematically until the corrections are made.

Switch inspection is so important that every man who is assigned to this work should be required to keep a written record of his findings.

New And Improved Devices

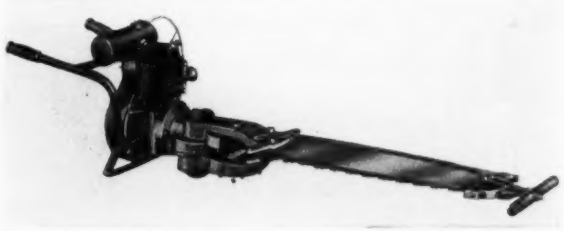
An Air-Operated Sump Pump

THE Chicago Pneumatic Tool Company, New York, has placed on the market an air-operated sump pump known as the CP Quimby sump pump. This pump, which is operated by the CP No. 88 rotary air motor, weighs 44 lb. and has a capacity of 100 gal. per min. at a 28-ft. head. It is said that, with this pump, steady capacities may be obtained at heads up to 50 ft. Priming of the pump is unnecessary and, in operation, the motor is started before the pump is lowered into the manhole or pit to be drained. Exhaust air from the pump is said to serve as an effective means of ridding the manhole or pit of dangerous gases or fumes while pumping. The pump has a ¾-in. air line and a 2½-in. water hose for an outlet, which facilitate the removal of the pump from job to job.

The CP Quimby Sump Pump

A Portable Gasoline Power Saw

THE Reed-Prentice Corporation, Worcester, Mass., manufacturer of portable power saws driven by both compressed air and electric power, has added a third means of propulsion by introducing a portable saw equipped with a gasoline engine. With the exception of the power plant, the new saw is essentially similar in construction to the electric-powered and air-operated units that have been described in previous issues of *Railway Engineering and Maintenance*. The motor consists of a four-horsepower, single-cylinder, two-cycle, air-cooled gasoline engine equipped with a Bosch magneto and a fuel tank carrying approximately two quarts of gasoline and oil, mixed in the proportion of one part of machine or cylinder oil and nine parts of gasoline.



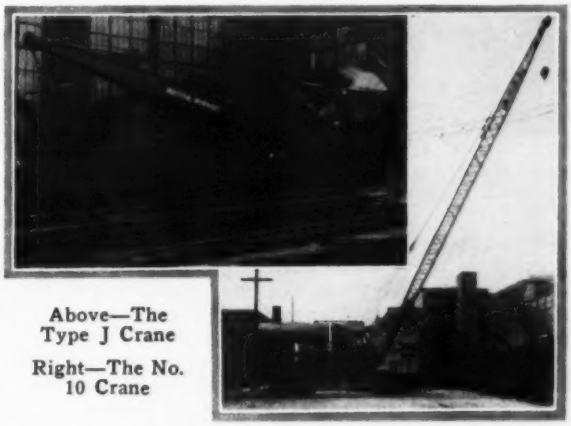
The New Saw in Position for Cutting Horizontally

The throttle of the engine is operated from the left handle and the chain is started and stopped independent of the motor by means of a multiple-disc clutch. The clutch is designed so that it will slip when the saw has a tendency to stall, thus eliminating the necessity of continually starting and stopping the engine. A swivel movement is provided which permits cutting to be performed in either vertical or horizontal planes, allowing the engine to remain in a vertical position. This saw is manufactured in 16-in. and 24-in. capacities, the former weighing 82 lb. and the latter 92 lb. It is said that the gasoline unit will cut just as rapidly as either the compressed air or electric unit.

Two New Heavy-Duty Locomotive Cranes

TWO NEW models of heavy-duty locomotive cranes have recently been introduced by the Industrial Brownhoist Corporation, Cleveland, Ohio, one of which is designated as Type J and the other as the No. 10 crane.

A new principle in locomotive crane design is involved in the construction of the No. 10 crane in that the boiler and bunkers are housed in a fixed compartment at the rear of the car body, while the control levers are contained in the forward rotating cab, thus making possible an unusually short rear overhang of the rotating cab. This cab has a radius from the center of the car of 5 ft. 2 in., which is within the limits of railroad clearances. This crane is equipped with an 80-ft. boom.



Above—The Type J Crane

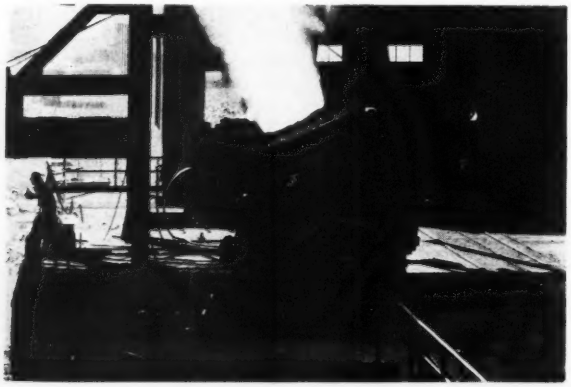
Right—The No. 10 Crane

The Type J crane is a combination crane and ditcher, having a high and low-speed traveling mechanism and a 75-in. boiler which is designed for a pressure of 200 lb. per sq. in. The operator's cab is situated at the right front corner of the crane, from which point the load is in full view at all times. The construction of this crane is extra heavy throughout.

Wrought Iron Now to Be Made by New Process

THE application of a new process to the manufacture of wrought iron on a commercial basis was commenced on October 8, when the new plant of the A. M. Byers Company at Ambridge, Pa., was formally opened. Although it was developed in 1926, the new process, which is known as the Byers process, has not heretofore been applied to the production of wrought iron on a large scale. This process is said to make possible a close metallurgical and chemical control of the product without quantity limitations or arduous labor.

For about 150 years wrought iron has been manufactured almost exclusively by the puddling process. In this process, which is carried out in a furnace, pig iron is converted into practically pure iron by the elimination of almost all of the elements other than iron itself. At one stage in this process, the iron is granular, and while in this condition, each grain is given a slag coating. The grains are worked by the puddler into balls and in this form the iron is removed from the furnace. The balls are then put through a squeezer and the resultant "bloom" is rolled in a mill. In this step the slag on the grains



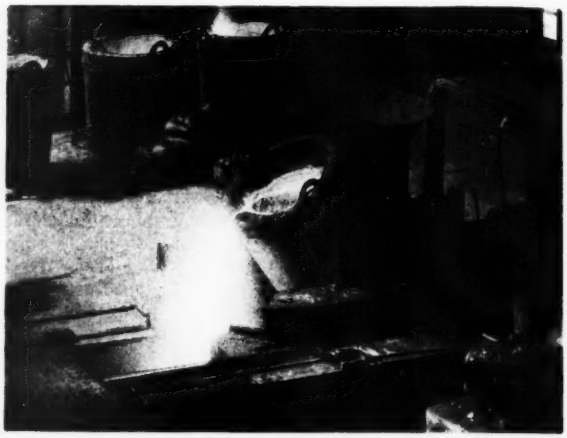
One of the Bessemer Converters for Removing the Impurities from the Molten Iron

is elongated into thin films which become interspersed in the iron in fibrous form.

In the Byers process the procedure is analagous in principle, but the manner of achieving the same objectives is different. Pure iron is obtained by melting pig iron in a cupola and then refining the molten metal in a Bessemer converter. This highly refined iron is carried in ladles to what is known as the "processing" platform where it is poured into processing cups containing a bath of slag. This slag, which is of a known composition, has been prepared in an open-hearth furnace and tapped into the cups. As the molten iron falls through the liquid slag it solidifies into a granular form and, as in the puddling furnace, each grain takes on a coating of slag.

A peculiar phenomenon takes place while the grains of iron are falling through the slag. As the stream of iron strikes the surface of the slag, it breaks into minute globules, in the interior of which a gas instantaneously collects. While these globules are descending, the gas pressure within them increases to a point where the hollow globules are completely shattered. This phenomenon permits the particles of metal to receive a complete coating of slag; and, thus, the action which in the puddling process gives wrought iron its peculiar merit, is carried out to even a greater degree in the Byers process.

After sufficient iron has been poured into the slag, the surplus slag is decanted and a ball similar in every respect, except weight, to that obtained in the



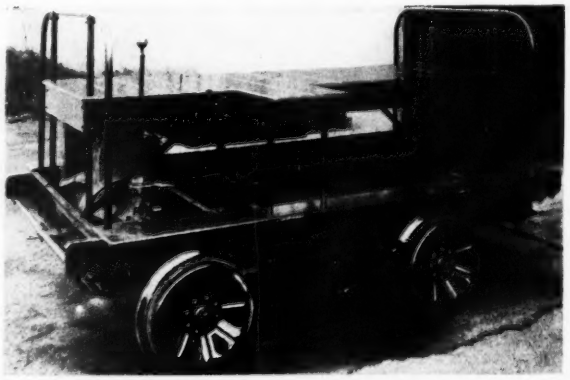
Pouring the Molten Metal into the Slag

puddling process is found in the bottom of the cup. This ball, instead of weighing 200 lb. as in the puddle furnace, weighs from 6,000 to 8,000 lb. The ball is then given the form of a bloom (or ingot) by means of a 9,000-ton press.

The plant at Ambridge contains equipment for the manufacture of plate, skelp and merchant mill products, such as rounds, flats, squares and other sections. It has a capacity of from 45,000 to 50,000 tons of wrought iron a month. This increased output is expected to broaden considerably the field of use of this metal in railway work as well as in other industries.

New Section Motor Car Has Special Features

A NEW section motor car, designated as the Kalamazoo No. 22A motor car, which has as special features an unusually large space for carrying tools and other equipment, the placing of the engine well forward on the car to secure easy handling of the car by two men, and the placing of the operator's seat so as to afford the driver an unobstructed view of the track



A View of the Kalamazoo No. 22A Section Motor Car

ahead of the car, has recently been developed by the Kalamazoo Railway Supply Company, Kalamazoo, Mich.

The motor car is powered with a two-cylinder, four-cycle, water-cooled, gasoline engine. The crankshaft is mounted on ball bearings and ignition is supplied through a high-tension Eisemann magneto. The car is equipped with a Zenith carburetor. A multiple-disc clutch is provided which is coupled to a selective gear transmission having three speeds forward and one in reverse, the operation of the car being similar to that of an automobile. Power is transmitted to three wheels by means of a chain to the front axle and thence to the rear axle.

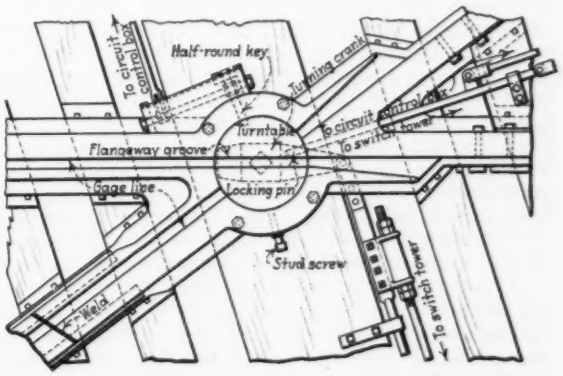
By locating the engine at the extreme forward end of the car, a large space for carrying tools is obtained under the seat. This space is 7¼ in. deep, 49¾ in. wide and 67 in. long. A compartment for carrying lunch pails is also built into the top of the seat. The driver's seat is located on the left side of the main seat and directly behind the engine controls, thus assuring that the operator's forward view will always be unobstructed. The car is also equipped with rail skids to facilitate its removal from the track.

New Type Rail Crossing Uses Turntable Principle

THE Continuous Rail Crossing Corporation, Los Angeles, Cal., has developed a type of railway crossing which is designed to provide a continuous running rail for the route which is cleared for the crossing. Briefly, the continuous principle of the crossing is furnished by four turntables, one at each rail intersection of the crossing so that a flangeway or groove in the top of the turntable may be turned to coincide with either rail, depending on which route is to be used over the crossing.

The movement of the turntables is effected and controlled by the interlocking plant which directs the train movements over the crossing. All pipe lines, rods, bell cranks, etc., conform to standard interlocking practice. The position of the turntables for either route is checked by electric circuit control boxes, as will be explained later.

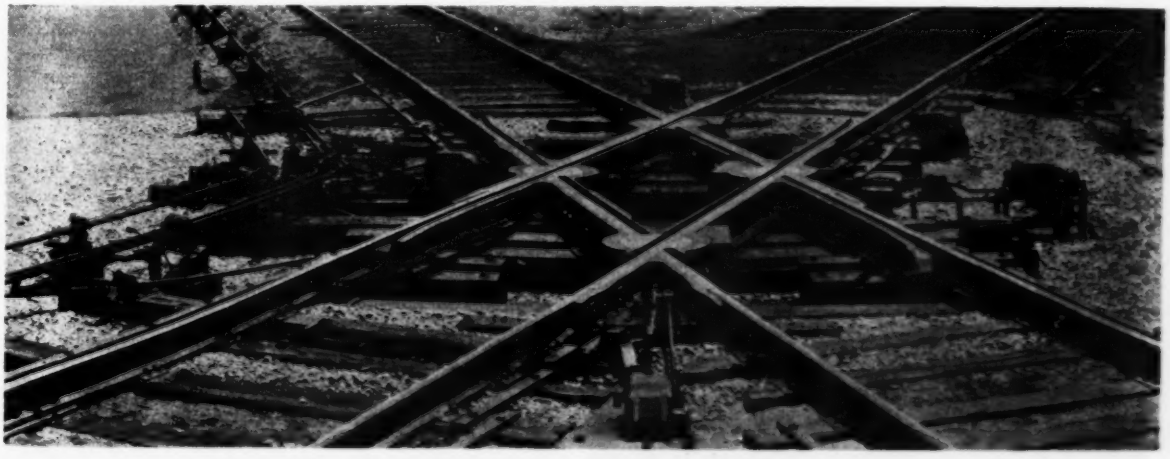
One of these crossings was installed at an intersection of the Southern Pacific and the Union Pacific at South Gate, Cal., about September 1. This crossing is of two-piece manganese-steel construction with circular wells to receive the turntables. The crossing is supported on four circular cast-steel pedestals, one of which is situated under each turntable and is provided with a circular opening in its top, through which the pivoting leg of the turntable extends downward to a connection with the operating mechanism. The pedestals, in turn, are supported on heavy timbers.



Turntable and Control Assembly at One Intersection

The detail dimensions of these crossings vary with the crossing angle, and all dimensions given hereafter are for an angle of 36 deg. 52 min., which is the angle of the crossing at South Gate. The turntables, which are made from forged, heat-treated, chrome-vanadium steel, are 15.99 in. in diameter, 5 in. deep and have a pivoting leg 7⅜ in. long. The lower end of the leg is $2\frac{13}{16}$ in. square for a length of 1⅝ in. to receive a crank 14½ in. long which is held in place by a 2-in. nut that is screwed on the lower threaded end of the leg. The outer end of the crank is connected to the piping system by means of which the turntable is turned.

When alined properly in either position, each turntable is locked in place by a 1¼-in. locking pin that extends into one of two radial holes in its circumference. These holes are 3½ in. deep and are so placed with respect to each other that one of the holes engages the stationary locking pin when the turntable is in either position. The locking pins are connected with and controlled from the tower through an independent system of piping. A connection is also made from each locking pin to a circuit control box, all four of which are con-



A View of the Installation of the New Crossing at South Gate

nected in series so that the four turntables must be locked before the block signals show a clear indication.

Another set of circuit control boxes assures that the turntables are all alined in the proper direction before the signal is released. The direction of alinement of the turntables is transmitted to the circuit control boxes by half-round keys, one of which extends into a groove in the circumference of each turntable when the turntable is in one position and is forced out of the groove when the turntable is rotated to the other position. Unless all four turntables are in the same position, the circuit to the control tower is not complete.

If a defect should occur in one of the turntables, an emergency turntable having grooves to coincide with both sets of flangeways may be inserted in the well. The emergency turntable is, of course, not movable and is not connected to the control mechanism or circuit.

In order that the turntables may be locked in any position on the ground, a stud screw is provided in the casting at each turntable, which may be run inward until it bears firmly against the side of the turntable, thereby locking it securely in one position. In order to prevent the turntables from freezing during cold weather, an oblong hole with an outlet is cast in the crossing around the inside bottom edge of each turntable well, in which an electrical heating unit can be installed.

Bucyrus-Erie Develops New 2¼-Yd. Machine

THE Bucyrus-Erie Company, South Milwaukee, Wis., has developed a 2¼-cu. yd. capacity Diesel shovel, known as the 52-B Diesel shovel, which has, as a special feature, extra wide and long caterpillar-type mountings for use when low ground bearing pressure is required. This machine is adaptable for

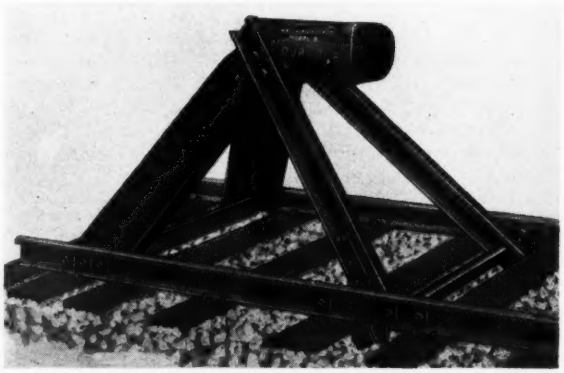
A View of the New Bucyrus-Erie 52-B Diesel Machine

use as a shovel, dragline, or crane. It is steered from the operator's seat and the swinging and hoisting operations are accomplished independent of the propelling operation.

The power plant consists of an Atlas-Bucyrus-Erie improved, four-cycle, six-cylinder, solid injection, full Diesel engine. All high-speed shafts are mounted on ball or roller bearings and the transmission gears, swing-reversing gears and all gears below the deck are enclosed and run in oil. Unit steel-casting construction is another feature of the shovel. The machine is so constructed that it can be shipped on a flat car without removing the revolving frame and cab from the base.

New Bumping Post Has Concave Striking Head

A FREIGHT and passenger bumping post having a concave striking surface and known as Durable Model D, has been developed and placed on the market by the Mechanical Manufacturing Company, Chicago. The concave head presents a point of direct contact for the coupler, whether it is in the central



The Durable Model D Bumping Post

position or is swung to one side at the moment of contact, while the design of the head is said to prevent the coupler from glancing or sliding past the head casting. In addition, the new bumping post has ample clearance for the new type metallic steam connections which are now used on some passenger cars.

Excluding the striking member, the construction of the new post is, in most respects, similar to that of other bumping posts which are manufactured by this company. The tension members consist of two straight sections of 85-lb. rail, each attached to the head by means of three bolts and to the track rails by three bolts also. These members extend below the track rails and are attached to a cross bar which is enclosed in a tubular sleeve.

The compression members consist of 12-in. steel channels attached to the track rails by means of three bolts each. These members are attached to the head by three bolts in such a manner that they are said to receive shocks and strains directly without shearing stress on the connecting rods.

Signal Tower at Madrid, Spain, Built Over the Tracks

WITH THE ASSOCIATIONS

Roadmasters Association

At a meeting of the Excutive committee following the adjournment of the last annual convention, it was decided that the next annual convention should be held on September 22-24, 1931. This brings the meeting into the fourth week of the month instead of the third as heretofore, and will avoid interference with the signing of payrolls, a task that confronts many roadmasters on the 1st and 15th of each month.

A committee consisting of C. W. Baldridge, J. J. Desmond and A. Chinn representing the Roadmasters Association, and D. J. Higgins and L. C. Ryan representing the Track Supply Association, has been appointed to consider and select the hotel for the next convention. A meeting of the Executive committee will be held in Chicago on December 6 to appoint committees and otherwise organize the work of the association for the new year.

Wood-Preservers' Association

The Excutive committee will meet in the office of the secretary in Washington, D. C., on November 14 to complete the arrangements for the next annual convention and to transact the routine business of the organization. Special items of business will be the receipt and consideration of reports of the Special Committee on the Processing of Wood and of the Preservative committee on recent changes in the methods of producing creosote oil and their affect on its value as a preservative.

Maintenance of Way Club of Chicago

The tenth annual dinner of the club was held at the Auditorium hotel, Chicago, on Wednesday evening, October 15, at which time Dr. Hermann von Schrenk, consulting timber engineer, St. Louis, Mo., presented an illustrated address on European Practices in Track Construction and Maintenance, particular attention being accorded the subject of crossties. During the course of a brief business session, James Sweeney, supervisor, C. & E. I., Danville, Ill., was elected president; J. P. Corcoran, roadmaster, C. & A., Bloomington, Ill., was elected first vice-president; C. T. Kimbrough, general roadmaster, I. H. B., Hammond, Ind., was elected second vice-president; and W. S. Lacher, managing editor, *Railway Engineering and Maintenance,* was re-elected secretary-treasurer.

At the next meeting, which will be held on Wednesday evening, November 19, C. A. Morse, former chief engineer of the Chicago, Rock Island & Pacific, will give a talk on Old-Time Railroad Experiences.

International Track Supervisors' Club

The next meeting of the International Track Supervisors' Club will be held on November 20, at the Hotel General Bock, Niagara Falls, Ontario, Canada, instead of at the usual place of meeting in Buffalo, N. Y. Following luncheon, which will be served at 1 p. m., papers will be presented on The Maintenance of Tie Tamping and Pneumatic Track Laying Equipment, by F. J. Ursem, special representative, Ingersoll-Rand Company, and on Snow Melting Devices, by J. B. Delitsch, assistant engineer, New York Central. The annual election of officers will take place at this meeting.

American Railway Engineering Association

Thirteen committees and a large number of subcommittees held meetings during the month of October with a view to getting their reports in shape for submission to the secretary before October 31.

Among the committees which met during the month were those on Yards and Terminals at Cleveland, Ohio, on October 6 and 7; Water Service and Sanitation at Chicago on October 7; Records and Accounts at Chicago on October 9; Iron and Steel Structures at Washington, D. C., on October 9 and 10; Uniform General Contract Forms at New York on October 10; Maintenance of Way Work Equipment at Chicago on October 14; Ballast at Chicago on October 17; Economics of Railway Labor at St. Louis, Mo., on October 17; Special Committee on Clearances at New York on October 20; Wood Preservation at Chicago on October 21; Rules and Organization at Chicago on October 24; Economics of Railway Location at Pittsburgh, Pa., on October 31; and Economics of Railway Operation at Cleveland, Ohio, on October 31.

Committee meetings scheduled for November include Masonry, November 6 and 7, Chicago; Rivers and Harbors, November 7, New York; and Wooden Bridges and Trestles, November 11, Chicago. In addition, the Board of Direction of the association has a meeting scheduled for this month in New York.

Reports are already in the hands of the secretary from the committees on Track, Grade Crossings, Water Service and Sanitation, and Maintenance of Way Work Equipment, while several other committees expect to complete their reports by the end of the month.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 20-22, 1931, Toronto, Ont.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 59 East Van Buren street, Chicago. Next convention, March 10-12, 1931, Palmer House, Chicago.

American Wood-Preservers' Association—H. L. Dawson, secretary, Washington, D. C. Next convention, January 27-29, 1931, Philadelphia, Pa.

Bridge and Building Supply Men's Association—S. A. Baber, secretary, High Grade Manufacturing Company, Cleveland, Ohio. Annual exhibit at convention of American Railway Bridge and Building Assocation.

National Association of Railroad Tie Producers—Roy M. Edmonds, secretary, Syndicate Trust Building, St. Louis, Mo.

National Railway Appliances Association—C. W. Kelly, secretary 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association—T. F. Donahue, secretary, 428 Madison street, Pittsburgh, Pa. Next convention, September 22-24, 1931, Chicago.

Track Supply Association—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

Roadmasters' Convention Party on the Inspection Trip to the Mills at Joliet

RAILWAY NEWS BRIEFLY TOLD

The number of railway employees on August 15 was 1,514,368, a reduction of 17,345 as compared with July 15 and a reduction of 13.93 per cent as compared with August, 1929, according to a report of the Interstate Commerce Commission. The decrease in the maintenance of way and structures group as compared with last year was 21.61 per cent.

Freight claim payments of 175 roads of the United States and Canada were $19,274,899 for the first six months of 1930 as compared with $18,510,037 for the same period of 1929, an increase of $764,862, or about 4.1 per cent, according to reports filed by these roads with the Freight Claim division of the American Railway Association. Of the total increase, 94.2 per cent is chargeable to vegetables.

Truck competition has compelled the Louisville & Nashville to reduce rates on cotton from points in Alabama and Florida to Mobile, Ala., and Pensacola, Fla. The rate of $2.35 a bale between Andalusia, Ala., and Pensacola, was reduced to $1.25 a bale, and the rate of $2.75 per bale from Graceville, Fla., was also reduced to $1.25. The Atchison, Topeka & Santa Fe was allowed to make effective on October 25 reduced rates on canned goods between California stations in order that it may compete adequately with motor trucks for a part of the available business.

Class I railroads spent $298,000,000 in 1929 for the improvement of safety and the protection of employees and the general public, according to a statement submitted by the American Railway Association to the Interstate Commerce Commission. Of this amount, $193,808,132 represented capital expenditures made for the improvement of safety and protection, $94,790,334 represented the cost of operating signals, protecting crossings and expenses of safety organizations, and $9,000,000 was spent for a wide variety of other purposes designed to bring about increased safety. Expenditures made for the protection or elimination of highway grade crossings totaled $28,445,680.

Freight traffic handled by the Class I railroads in August amounted to 37,420,502,000 net ton-miles, a reduction of 7,529,746,000 net ton-miles, or 16.8 per cent, compared with the same month of 1929, according to reports compiled by the Bureau of Railway Economics. The total freight traffic in the first eight months was 40,208,435,000 net ton-miles, or 12.4 per cent under that for the same 1929 period. The average speed of freight trains in August was 13.8 miles an hour, an increase of 0.7 mile per hour above this figure for August, 1929, and the highest for any August on record. The average daily movement per freight car in August was 28.9 miles, as against 33.5 miles for the same month last year.

Railways operating between Chicago and California are making an attempt to recapture some of their lost passenger traffic by reducing the fare in day coaches between these and some intermediate points considerably below the standard charge of 3.6 cents a mile. Since early last year these roads have resorted frequently to a coach fare of $52.50 between California and Chicago and of $47 and $30 to and from St. Louis, Mo., and Denver, Colo., respectively. These reductions have met with such success in increasing passenger travel that a further reduction to $47.50, or to about 2 cents a mile, in the coach fare between Chicago and California has been made in recent months and is to be continued during November.

The dedication of the new bridge of the Southern Pacific across Suisun bay between Port Costa, Cal., and Benicia, will take place on November 1. This structure is 5,603 ft. long and is said to be the longest and heaviest double-track railroad bridge west of the Mississippi river. The bridge is 70 ft. above the level of the water and has a 328-ft. lift span weighing 1,580 tons, which is said to be the largest of its kind in the world. The new bridge replaces the train ferry service which had carried the Southern Pacific overland and Shasta route trains between Port Costa and Benicia since 1879. At the dedication, the Southern Pacific's locomotive No. 1, the C. P. Huntington, which was brought to Sacramento, Cal., by ship around the Horn in 1864, led the first official train across the bridge.

Carloadings of the 29 principal commodities during the last quarter of the year will be 7,655,792 cars, a reduction of 600,120 cars, or 7.3 per cent, below the same period of 1929, according to reports of the shippers' regional advisory boards, as summarized by the American Railway Association. The only board to report an estimated increase is that of the Atlantic states, the expected increase being 4.1 per cent and due principally to anticipated increases in the movement of anthracite coal. The anticipated decreases in car requirements in the last quarter for the several regions range from 1.2 per cent in the New England region to 13.2 per cent in the Great Lakes region.

Following the refusal of the Interstate Commerce Commission to grant the request of a committee of presidents of western railroads for an informal conference with the commission to discuss the general condition of the railroads with particular reference to the western trunk line rate case and the western grain rate case, these roads have submitted two statements to the commission. The first of these was filed with the commission on October 27 through Wallace T. Hughes, general attorney for the Chicago, Rock Island & Pacific, in the form of a petition requesting the reopening of the western trunk line rate case. The purpose of the western lines is to obtain greater revenues and to remove defects in the commission's order of last May. The second statement was filed with the commission on October 29 by the Association of Western Railway Executives and outlined the present unsatisfactory financial status of the western lines. The statement cites the greatly reduced earnings of these roads, the steadily declining car loadings, the decrease of passenger travel, the failure of the roads to earn a fair return in any year since 1920, and the inroads of competitive forms of transportation on freight traffic.

Capital Expenditures Show Increase

Capital expenditures made by the Class I railroads in the first six months of this year for new equipment and for additions and betterments amounted to $468,305,000, an increase of $118,000,000 or nearly 34 per cent over these expenditures for the like period of 1929, according to R. H. Aishton, chairman of the Advisory committee of the Association of Railway Executives. Of the total expenditure, $187,486,000, or 40 per cent, went for new equipment and $280,819,000, or 60 per cent, for roadway and structures. Expenditures for additional main tracks, yards and sidings in the first six months totaled $52,634,000, for heavier rail $28,933,000, for bridges, trestles and culverts $28,975,000, and for additional ballast $6,151,000.

Construction News

Projects Contemplated

A. T. & S. F.—Construction of 319-acre industrial frontage on the Richmond inner harbor of San Francisco bay, involving the filling of 162 acres of submerged land.

C. N. R.—Construction of new freight shed, Fort William, Ont., and a 10-story brick and stone hotel of 275 rooms, Saskatoon, Sask.

G. M. & N.—Construction of terminal, New Orleans, La., including trackage, an enginehouse, a car repair shop and a locomotive machine shop, $1,250,000.

K. C. S.—Construction of brick combined freight and passenger station, Westville, Okla., $25,000.

Kansas City Term.—Has applied to I. C. C. for authority to cnstruct 4,500-ft. extension, Kansas City, Mo.

National of Mexico.—In connection with reorganization of lines to construct new union station, Mexico, D. F., $5,000,000.

Portland & Southeastern—Has filed application at federal land office, Roseburg, Ore., for permission to construct line over Hogg pass, Linn county, Ore., from junction of Marion creek and the North Santiam river to Sisters.

S. P. (Tex. & La. Lines)—Has filed petition with City Pub. Serv. Commr. for permission to construct perishable fruit and vegetable terminal, New Orleans, La., $900,000.

Toronto, Hamilton & Buffalo—Agreement with city of Hamilton, Ont., for elevation of one mile of line from 2 to 13 ft., construction of new passenger station and the construction of 7 underpasses, has been reached and placed before the Bd. of Ry. Commrs. of Can. for approval.

Approved by Commissions

B. & M.—Plans and estimate of $123,900 for elimination of Main and Burton st. grade crossings, Valley Falls, N. Y., approved by Pub. Serv. Com. of N. Y. Elimination of grade crossing of Rotterdam Junction-Pattersonville county highway, Rotterdam Junction, N. Y., ordered by Pub. Serv. Com. of N. Y., $165,000.

B. & M.-D. L. & W.—Elimination of Hubbs and Dyers grade crossings, Elnora station, Clifton Park, N. Y., by construction 273-ft. overhead bridge between crossings, ordered by Pub. Serv. Com. of N. Y., $122,000.

B. R. & P.—Pub. Serv. Com. of N. Y. has designated for elimination four grade crossings, Great Valley, Cattaraugus county, N. Y.

Erie—Elimination of Oquaga crossing on McClure-Oquaga Lake road near Deposit station, Sanford, N. Y., by construction of underpass, ordered by Pub. Serv. Com. of N. Y., $119,000. Commission has designated for elimination the Sawyer grade crossing, Owego station, Tioga county, N. Y., $164,853. Commission has also approved revised estimate of $262,400 and revised general plan for elimination of Big Tree Road crossing, Hamburg, Erie county, N. Y.

Erie-L. V.—Ordered by Pub. Serv. Com. of N. Y. to eliminate William and South Ogden st. crossings, Buffalo, N. Y., by depressing grade of William st., $1,200,000.

L. V.—Elimination of Alden-Crittenden county highway crossing, Mill Grove station, N. Y., by construction of overpass, and elimination of Cedar Swamp road crossing on Rush-Henrietta county highway, Henrietta, N. Y., by construction of overpass, $124,000, ordered by Pub. Serv. Com. of N. Y. Estimate of $102,000 and detail plans for elimination Ridge road crossing, West Seneca, N. Y., approved by Pub. Serv. Com. of N. Y. Commission has designated for elimination Tioga st. crossing, Spencer, Tioga county, N. Y., $121,200.

N. Y. C.—Pub. Serv. Com. of N. Y. has approved plan for elimination Storm King and Breakneck crossings south of Storm King station, N. Y., by construction 825-ft. tunnel; and an estimate totaling $50,000 for construction of Tower H in connection with elimination of grade crossings at Austin, Amherst, Tonawanda and other sts., Buffalo, N. Y. Com. has ordered elimination grade crossing of Alden-Crittenden county highway, Crittenden station, Alden, N. Y., $130,150, and another crossing at Montrose station, Cortland, N. Y.; also elimination Ridge road and Orchard Park highway crossings, West Seneca, N. Y., by construction of overhead structures, $88,600 and $196,000, respectively. Com. has approved plans and estimate of $111,700 for elimination of Culver ave. crossing, Utica, N. Y. Plans showing location new station in Weschester Co., N. Y., to be built as result of relocation of line between East View, N. Y., and Briarcliffe Manor, also approved by Com.

N. Y. N. H. & H.—Pub. Serv. Com. of N. Y. has ordered changes in Cochecton turnpike viaduct, Montgomery, N. Y., $79,000, and has approved estimate of $25,600 for widening highway bridge at Post county highway, Lloyd, N. Y.

N. P.—Construction of bascule bridge across Duwamish river, Seattle, Wash., approved by U. S. War Dept., $327,000.

Ozark & Philpott Valley—By I. C. C. to construct line from Ozark, Ark., northeasterly 7 miles.

Penna.—Pub. Serv. Com. of N. Y. has ordered elimination of grade crossing of Clymer-Panama highway, Panama station, Clymer, N. Y., by construction underpass 132 ft. southwest present crossing, $138,000; and elimination of River Road grade crossing on Rochester-Scottsville county highway, Scottsville station, Chili, N. Y., by construction of overpass, $139,400.

Rutland—Elimination of Bell highway crossing, Brushton, N. Y., by construction of underpass, approved by Pub. Serv. Com. of N. Y., $134,000.

Term. R. R. Assn. St. Louis—By Illinois Commerce Commission to construct union station with accompanying facilities at South Main st., East St. Louis, Ill., $700,000.

Rail Orders Now Being Placed

Within recent weeks 19 railroads have placed orders for 371,000 tons of rail for their 1931 requirements. The largest order yet placed is that of the Atchison, Topeka & Santa Fe for 61,251 tons, which is followed closely in order of magnitude by those of the Chesapeake & Ohio for 58,600 tons and the Chicago, Burlington & Quincy for 57,100 tons. The Union Pacific has ordered 45,000 tons, the Norfolk & Western 40,000 tons and the Reading 30,000 tons, while numerous smaller orders have been placed by other roads. The Erie is inquiring for 40,000 tons, while the New York Central and the Baltimore & Ohio are contemplating the purchase of 175,000 tons and 75,000 tons, respectively.

Projects Authorized

B. & O.-Erie—To participate with Northern Ohio Power & Light Co., in elimination of two grade crossings, Leavittsburg, Ohio, $300,000.

C. N. R.—Construction of freight shed, Ft. William, Ont., to replace structure destroyed by fire, construction of 140 miles new branch lines in Prairie provinces, all for purpose of stimulating employment and business activity.

C. & O.—Construction of undergrade crossing at Magnolia st., Richmond, Va., $25,550.

Long Island—Construction of additional duct lines, Ozone Park, N. Y., and additional freight and passenger facilities, including new passenger station, Corona, N. Y., in connection with extensive grade separation work at these two points.

N. Y. N. H. & H.—Installation of additional fire protection for car and locomotive shops, Readville, Mass., $35,000; and reconstruction of bridges 8.69 and 10.63, Derby, Conn., $25,000. Has reached agreement with city of Port Chester, N. Y., for construction of bridge at Boston Post road in that city, $232,000.

Reading—Construction of brick and terra cotta passenger station, 81 ft. by 27½ ft., and a brick freight station, 96 ft. by 30 ft., and elimination of grade crossing at Main st., Royersford, Pa.

S. P.—Construction of subway at Victory place, Burbank, Cal.

Bids Received

C. N. R.—Construction of subway on Simcoe st., Oshawa, Ont.

C. P. R.—Until December 1 for driving a tunnel from Burrard inlet, Vancouver, B. C., to yards, False Creek, B. C., 4,609 ft., and for the placing of a 2-ft. concrete lining, to eliminate six street crossings, $1,750,000.

C. & O.—Enlarging of White Sulphur tunnel, White Sulphur, W. Va., $118,500.

Cin. (Ohio) Union Term.—For construction of Western Hills viaduct, Cincinnati, 3,500 ft. long, to have an upper deck for passenger automobiles and a lower deck for street cars and trucks, $3,500,000.

Contracts Awarded

A. T. & S. F.—Construction electric engine coaler with 70-ton track hopper, 18th st. yard, Chicago—Roberts & Schaefer Co., Chicago.

B. & O.—Erection of water-treating plant, Connersville, Ind.—Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa., and construction of a steel and concrete grade separation structure, Kearneysville, W. Va.—Empire Const. Co., Baltimore, Md., $250,000.

C. N. R.—Reconstruction of dock at foot of Main st., Vancouver, B. C., recently destroyed by fire—Northern Const. Co., Vancouver. Construction of street subway, East Windsor, Ont.—Canada Paving & Supply Corp., Windsor, Ont., $178,000. In connection with Montreal (Que.) terminal program, construction of main viaduct into central passenger terminal from Victoria bridge—Atlas Const. Co. and Foundation Co. of Can.; former from north line of St. Antoine st. to St. Paul st, and latter from St. Paul st. to south line of Ottawa st. Viaduct will have three floors, first two to be used as garages, warehouses, etc., third to have eight tracks. Construction of two bridges to carry Guy and Mountain sts. over tracks at entrance to Bonaventure station; masonry abutments and approaches—Kennedy Const. Co., Montreal; steel superstructure—Dominion Bridge Co.

C. P. R.—Alteration of building, Windsor, Ont., to serve as ticket, telegraph and express office—John V. Gray Const. Co., Toronto, Ont., $65,000. Grading of new lines as follows: Nipawin, Sask., to Henribourg, 20 miles—Fred Mannix, Calgary, Alta; Rosetown, Sask., to Gunnworth, 20 miles—Foley Bros., Winnipeg, Man.; Medstead, Sask., to Meadow Lake, 35 miles—Fred Mannix; Hamlin, Sask., northeasterly 25 miles—Roosa & Wickstrand, Vermillion, Alta.

C. & O.—Improvements to locomotive shops, Clifton Forge, Va.—J. A. Fix & Sons, Lynchburg, Va., $153,460.

C. & N. W.—Construction of concrete block and stucco station, Hurley, Wis.—Henry Danischefsky, Milwaukee, Wis.

C. R. I. & P.—Construction of reinforced concrete highway subway at South Walker ave., Oklahoma City, Okla.—John W. Fox, El Reno, Okla., $200,000.

Donora Southern—Construction 6-mile line, Monongahela, Pa., connecting with Connellsville extension of P. & W. V.—Vang Const. Co., Cumberland, Md., $1,200,000.

G. N.—Superstructure and machinery for new 186-ft. deck plate-girder swing bridge, Colebrook, B. C.—Western Bridge Co., Vancouver, B. C.

I. C.—Construction of substructure for a viaduct to carry Randolph st., Chicago, over tracks—R. T. Hanrahan, $192,720.

Kansas City Term.—Construction of 248-ft. conveyor to connect sub-basement of Kansas City (Mo.) Union station with Post Office basement—List & Weatherly Const. Co., Kansas City.

M. C.—By Ontario Highways Dept for construction of viaduct to carry King's highway over M. C. tracks, Waterford, Ont.—Grant Bros. Const., Co., Ottawa, Ont., $160,000.

Monessen Southwestern—Construction of line between Monessen, Pa., and Belle Vernon—Vang Const. Co., Cumberland, Md., $200,000.

Mont. Power Co.—Construction of line from point on N. P. between Pablo, Mont., and Polson, to point on Flathead river, 8 miles—S. Burch & Son Construction Company, Great Falls, Mont.

N. Y. C.—Installation of boilers, accessories and piping for a pumping station, Clifton Point, N. Y.—Edward Joy Co., Syracuse, N. Y. Also construction three grade crossing eliminations: Holley, N. Y.—Erie Contr. Co., Buffalo, N. Y.; and Mapleview, N. Y., and Central Square—William M. Ballard, Inc., Buffalo, N. Y.

N. Y. N. H. & H.—Construction of substructure, deck and approaches for grade separation structure, Noank, Conn.—C. W. Blakeslee, New Haven, Conn., $38,000.

N. & W.—Construction of extensions to freight terminals, Lamberts Point, Va., including 700-ft. addition to warehouse F and 650-ft. addition to warehouse D—J. F. Pettijohn & Co., Lynchburg, Va., $200,000.

O.-W. R. R. & N.—Construction of 500-ft. double-track, concrete-lined tunnel, Rowena Pt., Ore.—J. F. Shea Contr. Co., $190,000.

Penna.—C. C. C. & St. L.—Structural additions and alterations and construction of new train concourse at Union passenger station, Columbus, Ohio—Boyajohn & Barr, Columbus; rearrangement of tracks and platforms and construction of drainage system at same point—Fritz-Rummer-Cooke Co., Columbus.

P. & W. V.—Construction of substructure and superstructure of bridge over Youghiogheny river on Connellsville extension—Vang Const. Co., Cumberland, Md., and American Bridge Company, New York, respectively. Construction of four miles of line, Connelsville, Pa., as part of Connelsville extension—Vang Const. Co., Cumberland, Md., $800,000.

On the New York Central at Elkhart, Ind.

Supply Trade News

General

Purdom Railway Supplies, Straus building, Chicago, has been organized by **A. H. Purdom,** formerly sales engineer of the **Wood Conversion Company,** to handle railway supplies.

Fairmont Railway Motors, Inc., is carrying out a $200,000 building program which includes the completion of a new factory at Fairmont, Minn., by about November 1. This company also plans to construct a new office building at this point.

The carbon sales division of the **National Carbon Company, Inc.,** Cleveland, Ohio, on November 1, commenced the sale and distribution of the entire line of Gredag lubricants which is manufactured by the **Acheson Graphite Corporation,** a unit of the **Union Carbide & Carbon Corporation,** New York.

The National Lock Washer Company, in a general program of enlarging its manufacturing facilities, has added a new modern four-story, reinforced concrete building, having a floor area of 50,000 sq. ft., to its plant at Newark, N. J. While this new building is being used mainly for the manufacture of car window equipment and for the machining of drop forgings, its construction has made available large additional areas in the older buildings of the plant for the production of lock washers and other products of the company.

The General Water Treatment Corporation has been organized under Delaware laws as a holding company to merge the interests of the **Permutit Company,** New York, and the **Ward-Love Pump Corporation,** Chicago, both specialists in equipment for the softening and purification of water, as well as in allied chemical and mechanical lines. **W. Spencer Robertson,** president of the Permutit Company, will be president of the corporation and **Francis N. Bard,** president of the Ward-Love Pump Corporation, will be chairman of the board of directors. Other board membes will be: **Vincent Bendix, Harry M. Durning, William M. Flook** and **Kenneth B. Schley.**

The American Rolling Mill Company, Middletown, Ohio, has organized a railroad division with headquarters at Middletown. **Logan T. Johnston,** formerly assistant to the vice-president in charge of the commercial activities of the forged steel wheel division, has been appointed manager of the new division, and **H. M. Arrick** has been appointed assistant manager. **C. G. Bacon** has been made director of wheel research. Under the new division, district offices have been established at New York, Chicago and St. Louis, Mo. **W. B. Quail** has been appointed manager of the New York office and is being assisted by **W. A.**

Dibblee and **E. C. Gray**, the latter with headquarters in Philadelphia, Pa. **Ernest Baxter**, vice-president in charge of railroad sales of the **Sheffield Steel Corporation**, has been appointed manager of the Chicago office in addition to his other duties, and **F. E. Finley** has been made manager of the St. Louis office.

Personal

Frederick M. Kreiner, secretary and treasurer of **Manning, Maxwell & Moore, Inc.**, New York, has also been elected a vice-president.

W. C. Buchanan, assistant to the president of the **Keystone Steel & Wire Company**, Peoria, Ill., has been elected vice-president and assistant general manager.

L. L. Caskey, assistant manager of the strip steel division of the **Republic Steel Corporation**, has been appointed assistant manager of sales for the Philadelphia (Pa.) district.

B. E. Mercer, general superintendent of the **Union Steel Casting Company**, subsidiary of the **Blaw-Knox Company**, Pittsburgh, Pa., has been elected a vice-president of the company.

The Universal Power Shovel Company, division of the **Unit Corporation of America**, Milwaukee, Wis., has appointed the **Tractor & Equipment Company**, 520 Passaic avenue, Newark, N. J., its representative in the eastern territory.

Paul Z. Van Zandt, at one time chief engineer of the Asano Portland Cement Company, in Tokyo, Japan, and more recently associated with the Ideal Cement Company, has been appointed assistant to the president of the **Universal Atlas Cement Company**, Chicago.

F. H. Maloney, manager of the St. Louis (Mo.), office of the **Truscon Steel Company**, Youngstown, Ohio, has resigned to become representative of the **Campbell Industrial Window Company**, New York.

J. T. Conners, district manager of the **Thew Shovel Company**, at Detroit, Mich., has resigned to become a representative of the **American Hoist & Derrick Company**, and will have charge of "American Gopher" sales. The American Hoist & Derrick Company has moved its Dayton (Ohio) office to Indianapolis, Ind.

C. S. Powers has been appointed district manager of the **Republic Steel Corporation**, Youngstown, Ohio, with headquarters at Tulsa, Okla. This company has consolidated its Western and Chicago district sales offices, and has placed **H. S. Schoeder**, western manager of sales, in charge.

L. C. Hensel, formerly manager railway sales of the Gould Storage Battery Company, has been appointed vice-president of **Utilities Accessories, Inc.**, New York, with which company he will be in charge of sales and engineering activities. Utilities Accessories, Inc., of which **Charles J. Gale** is president and treasurer, and **Lewis Karasik**, secretary, was formed for the purpose of selling railroad and public utility supplies and accessories, but now is concentrating on the promotion and sale of Rust-oy, a special rust preventative developed by E. M. Williams, chemist and metallurgist. **John W. O'Connor** and **Frank J. Houghtalin** have been appointed special representatives in the eastern territory.

G. C. Stephenson has been appointed manager, creosote department of the **American Tar Products Company**, Pittsburgh, Pa., with headquarters in that city. He was born on June 4, 1898, at Oneida, Ill., and graduated from Lombard College in 1920. On July 1 of the same year, he entered railway service as a chemist on the Atchison, Topeka & Santa Fe and was transferred to the Santa Fe Tie & Lumber Preserving Company, Somerville, Tex., on August 1, 1923. He left this company on April 15, 1925, to become associated with the Port Reading (N. J.) creosoting plant of the Reading and the Central of New Jersey as chemist, being promoted to superintendent of this plant in 1926. He resigned from this position on September 1, 1929, to become associated with the American Tar Products Company, receiving his recent promotion on September 15 of this year.

G. C. Stephenson

Frank Baackes, vice-president of the American Steel & Wire Company, Chicago, died on October 19 following an illness of more than a year's duration. He was born in Germany on March 9, 1863, and came to America at the age of 15. From 1879 to 1881, he was connected with the nail business in Cleveland and in the latter year was employed by the Hartman Steel Company at Beaver Falls, Pa., to assist in the construction of its wire nail plant. While with this company, he undertook a series of experiments which resulted in producing what is now known as the standard wire nail. In July, 1885, he organized and became general manager of the Salem Wire Nail Company, of Salem, Ohio, which position he held until April, 1898, when the company was absorbed by the American Steel & Wire Company of Illinois, of which he became general manager. Upon the absorption of this company in January, 1899, by the American Steel & Wire Company of New Jersey, he was promoted to general superintendent and in 1900 was elected general sales agent and a director of the company. In 1905, he was elected vice-president, which position he held until his death.

Frank Baackes

C. B. Nolte, whose election as president and general manager of the **Robert W. Hunt Company**, Chicago, to succeed **John J. Cone**, resigned, was noted in the October issue, graduated from the University of Illinois in 1909 and soon afterward entered the employ of Robert W. Hunt & Co. He served as inspecting and testing engineer in various departments of this company until 1913, when he was appointed manager of the railway materials inspection and testing department. In 1919 he was appointed assistant to the president and in 1923, when the company was incorporated under the name of the Robert W. Hunt Company, he was elected vice-president and general manager, which position he has held until his recent promotion.

C. B. Nolte

Mr. Cone was one of the founders of Robert W. Hunt & Co., the predecessor of the Robert W. Hunt Company,

having been associated with Captain Robert W. Hunt in 1888 in organizing that firm. In 1923, when the Robert W. Hunt Company was incorporated, Captain Hunt was its first president

John J. Cone

and coincident with his death in the same year, Mr. Cone was elected president, which position he has filled until his recent resignation.

J. C. Ogden, whose election as vice-president of the **Robert W. Hunt Company** was also noted in the October issue, entered the employ of the company almost 30 years ago as an inspector of structural steel. He was made manager of the New York office in

J. C. Ogden

1906, and when the Robert W. Hunt Company was incorporated in 1923, he was elected a director and made eastern manager. Mr. Ogden has specialized in the design and inspection of bridges, steel-framed buildings and safe deposit vaults.

Trade Publications

Railway Steel Crossties.—This is the title of a 38-page illustrated booklet which has recently been published by the Carnegie Steel Company, Pittsburgh, Pa., and which contains valuable data concerning the steel crossties that this company manufactures. The data include the weights and dimensions of the various sections, as well as similar information in regard to the fastenings.

Personal Mention

General

W. S. King, tie and timber agent of the Chesapeake & Ohio, with headquarters at Richmond, Va., has moved his headquarters to Cleveland, Ohio.

C. A. Johnston, division engineer of the Detroit division of the Wabash, has been promoted to superintendent of the same division, with headquarters as before at Montpelier, Ohio.

C. E. Zortman, supervisor of track on the Williamsport division of the Pennsylvania, with headquarters at Lewisburg, Pa., has been appointed safety agent on the Central Pennsylvania division.

Engineering

R. E. Butler, engineer maintenance of way of the Newburgh & South Shore, has been promoted to chief engineer, with headquarters as before at Cleveland, Ohio.

J. L. Tanner has been appointed office engineer on the Missouri-Kansas-Texas, with headquarters at Dallas, Tex., succeeding **L. W. Willis**, who has resigned.

C. H. Brodbeck, division engineer of the Paducah & Memphis division of the Nashville, Chattanooga & St. Louis, with headquarters at Paducah, Ky., has moved his headquarters to Nashville, Tenn.

S. F. Ryan, maintenance inspector on the Wabash, with headquarters at St. Louis, Mo., has been promoted to division engineer of the Springfield division, with headquarters at Springfield, Ill., succeeding **H. B. Pilcher**, transferred.

C. T. Jackson, special engineer on the Chicago, Milwaukee, St. Paul & Pacific with headquarters at Chicago, has been appointed district engineer of the Southern district with the same headquarters, succeeding **D. C. Fenstermaker**, assigned to other duties, effective November 1.

W. L. Young has been appointed crossing engineer on the Norfolk & Western, with headquarters at Roanoke, Va., succeeding **H. N. White**, who has been appointed assistant engineer on the Norfolk division, with headquarters at Norfolk, Va., to replace **E. H. Roth**, who has been transferred to the Pocahontas division, with headquarters at Bluefield, W. Va., to take the place left vacant by the death of **J. W. Raitt**, which is noted elsewhere in these columns.

M. B. Kent, division engineer of the Houston division of the International-Great Northern, with headquarters at Houston, Tex., has been appointed division engineer of the Houston terminals, with the same headquarters. The position of division engineer of the Houston division has been discontinued and the territory of that division has been added to the Palestine division, of which **S. Beacon** is division engineer, with headquarters at Palestine, Tex.

W. H. Phelps, division engineer of the East Bay Electric division of the Southern Pacific, with headquarters at Oakland, Cal., has been appointed assistant division engineer, with headquarters at Oakland Pier, Cal., following the consolidation of the East Bay Electric division with the Western division.

C. F. Hinchman, division engineer of the Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Mt. Carmel, Ill., has been appointed special engineer in the office of the chief engineer, with headquarters at Cincinnati, Ohio. The Cairo division has been combined with the Terre Haute division and, as noted in the October issue, **W. H. Miesse**, division engineer of the latter division, has had his jurisdiction extended to include the Cairo division.

The three positions of district engineer on the Baltimore & Ohio have been abolished and **A. C. Clarke**, who filled that position at Pittsburgh, Pa., has been appointed assistant chief engineer at that point; **A. H. Griffith**, at Cincinnati, Ohio, has been appointed assistant to the chief engineer at the same point and **Richard Mather**, at Baltimore, Md., has been appointed assistant to the chief engineer at that

E. L. Gosnell

point. **E. L. Gosnell**, assistant to the chief engineer, has been appointed principal assistant engineer, with headquarters as before at Baltimore, Md.

Mr. Gosnell was born on August 17, 1887, at Granite, Md., and was educated at St. Johns College, Annapolis, Md. He took up railway service on September 12, 1906, with the B. & O. on construction work and has been with that company continuously to the present, with the exception of about two years during 1914-16, when he was out of railway service. After returning to the

B. & O. on February 15, 1916, he served as resident engineer, assistant engineer and office engineer with headquarters at Cincinnati, Ohio. On December 1, 1918, he was promoted to assistant to the chief engineer with headquarters at Baltimore, holding this position until his recent appointment.

Mr. Clarke was born at Granton, Ont., Can., on May 16, 1888, and graduated from Purdue university in 1915. Prior to his graduation, he served in various positions on engineering and construction work with the Lake Shore & Michigan Central (now part of the New York Central) and the Canadian government. In October, 1908, he became chief of the Bureau of Information and Statistics, Department of Agriculture of the Province of Saskatchewan, Can., and in October, 1909, he became assistant engineer with the Canadian Govern-

A. C. Clarke

ment survey system. Mr. Clarke entered the service of Reilly, Dawson & Reilly, Regina Sask., in January, 1911, as engineer in charge of field work, and remained in that position until September, 1911, when he entered school at Purdue university. In June, 1915, after his graduation, Mr. Clarke was appointed special engineer on the B. & O. at Baltimore, being in July, 1916, appointed chief of the facilities bureau at the same point. He was promoted to assistant to the chief engineer in May, 1917, being further advanced to district engineer at Pittsburgh, Pa., in November, 1918, which position he held until his recent appointment.

Track

J. W. Swartz, supervisor of track on the Illinois Central, with headquarters at Springfield, Ill., has moved his headquarters to Litchfield, Ill.

A. P. Gardner, has been appointed maintenance inspector on the Wabash, with headquarters at St. Louis, Mo., to succeed **S. F. Ryan**, whose promotion to division engineer is noted elsewhere in these columns.

H. B. Moore, roadmaster of the East Bay Electric division of the Southern Pacific, with headquarters at Oakland, Cal., has been transferred to Oakland Pier, Cal., following the consolidation of the East Bay Electric division with the Western division.

R. A. Brown, division engineer of the Cedar Rapids division of the Chicago, Rock Island & Pacific, with headquarters at Cedar Rapids, Iowa, has been appointed roadmaster at Goodland, Kan., to replace **J. S. Pollard**, who has been granted a leave of absence on account of ill health.

J. E. Campbell, district roadmaster on the Great Northern, with headquarters at Hillyard, Wash., has been promoted to division roadmaster of the Kalispell division, with headquarters at Whitefish, Mont., succeeding **F. A. Larson**, who has been appointed district roadmaster at Hillyard.

J. B. Raymond, division engineer of the Pecos division of the Atchison, Topeka & Santa Fe, with headquarters at Clovis, N. M., has been appointed roadmaster on the Plains division of the Panhandle & Santa Fe, with headquarters at Amarillo, Tex., succeeding **G. B. Hickok**, transferred. As noted in October issue, **J. A. Noble**, division engineer at La Junta, Colo., succeeds Mr. Raymond at Clovis.

H. Neiderhelm, roadmaster on the Eastern division of the Missouri Pacific, with headquarters at Sedalia, Mo., has been transferred to Booneville, Mo., on the same division, to succeed **H. M. Noel**, who has been transferred to the Joplin division, with headquarters at Carthage, Mo. Mr. Noel replaces **E. Lyberger** who has been transferred to Pittsburg, Kan., succeeding **L. Mead**. The position of roadmaster at Sedalia has been abolished.

J. E. Dixon, general foreman of track on the Delmarva division of the Pennsylvania, with headquarters at Clayton, Del., has been promoted to assistant supervisor of track on the Maryland division, with headquarters at Perryville, Md., succeeding **W. T. Miller**, whose transfer to the Philadelphia Terminal division was noted in the October issue. **M. C. Fox**, assistant supervisor on the Baltimore division, with headquarters at York, Pa., has been transferred to the Delmarva division with headquarters at Clayton, Del.

E. A. Wheaton, whose promotion to supervisor of road on the Baltimore & Ohio, with headquarters at Defiance, Ohio, was noted in the October issue, was born on July 7, 1884, at Sherwood, Ohio. He commenced his railway service on September 16, 1906, with the B. & O. and has been with that road continuously to the present. He was appointed a track foreman on August 1, 1912, and retained this position until his recent promotion to supervisor, effective August 1. From time to time Mr. Wheaton served as extra-gang foreman on various projects and during this year prior to his promotion he served as general foreman of a rail-laying gang.

L. V. Barrett, who has been on special service on the Fitchburg division of the Boston & Maine, in charge of the ballast work, will return to his former duties as track supervisor on District No. 3, with headquarters at Concord, N. H. **O. C. Benson**, who has been acting track supervisor on Mr. Barrett's territory has been appointed track supervisor on District No. 4, with headquarters at Plymouth, N. H., succeeding **D. J. Vallier**, who has been appointed assistant track supervisor on District No. 3, with headquarters at White River Junction, Vt., replacing **N. J. McDonald**, assigned to other duties. **John F. Malloy**, general foreman on the Fitchburg division, with headquarters at North Adams, Mass., has been promoted to assistant track supervisor with headquarters at Brattleboro, Vt., succeeding **J. J. O'Rourke**, assigned to other duties.

A. L. Hilburn, has been appointed roadmaster on the Los Angeles & Salt Lake, with headquarters at Kelso, Cal., succeeding **H. F. Kretlow**. Mr. Hilburn was born on April 9, 1899, at Odessa, Tex., and entered railway service with the Los Angeles & Salt Lake in February, 1922, as a trackman, resigning in May of the same year, but re-entering the service in the same position three months later. He left this road again in October, 1922, and did not re-enter the service until October, 1924, when he was made a pumper. Resigning again three months later, he re-entered the employ of the L. A. & S. L. in January, 1925, as a laborer on a ballast gang. He became a trackman again in April, 1925, and was promoted to track foreman in October of the same year. In July, 1927, Mr. Hilburn was appointed extra-gang foreman, serving in this position and as track foreman until December 31, 1929, when he was promoted to assistant roadmaster. He retained this position until his recent promotion to roadmaster, effective September 30.

R. R. Rex, assistant supervisor of track on the New York Central, with headquarters at Kentland, Ind., has been promoted to supervisor of track, with headquarters at Gibson, Lake County, Ind., succeeding **E. H. Strine**, whose death was noted in the October issue. **A. Long**, assistant supervisor of track, with headquarters at Elkhart, Ind., has been transferred to Kentland, to succeed Mr. Rex. The position of assistant supervisor of track at Elkhart has been abolished.

Mr. Rex was born on December 5, 1892, at Kendallville, Ind., and after attending high schol at Kankakee, Ill., commenced his railway career in 1910 as a trackman on the Chicago, Indiana & Southern (now part of the New York Central). From this date until 1916 he served as trackman, extra-gang laborer, extra-gang timekeeper and assistant extra-gang foreman, being on the latter date appointed clerk to supervisor of track. A year latter Mr. Rex left railway service to enter the World war, returning to the position of clerk to supervisor in 1919. He served in this position and as chief clerk until 1923, when he was appointed

assistant supervisor of track, holding this position until his recent promotion, effective October 1.

Bridge and Building

H. C. McNaughton, supervisor of bridges and buildings on the Boston & Maine, with headquarters at Springfield, Mass., has been transferred to Concord, N. H., succeeding **John W. Gannon.**

H. M. Bryant, inspector of water service on the Missouri Pacific, with headquarters at St. Louis, Mo., has been appointed assistant supervisor of bridges and buildings on the Central and Southern Kansas divisions, with headquarters at Coffeyville, Kan., to succeed **W. C. Webster.**

W. J. Mahoney, supervisor of bridges and buildings on the Atlanta division of the Louisville & Nashville, with headquarters at Etowah, Tenn., has been transferred to the Nashville division, with headquarters at Nashville, Tenn., succeeding **R. O. Elliot,** whose retirement was noted in the September issue.

D. Joslin, bridge and building supervisor of the Nashville division of the Nashville, Chattanooga & St. Louis, with headquarters at Dickson, Tenn., has had his jurisdiction extended to include the Paducah & Memphis division. **J. D. Shaver,** bridge and building supervisor of the P. & M. division, with headquarters at Jackson, Tenn., has been appointed a bridge and building foreman on the Huntsville division.

W. C. Waggoner, supervisor of bridges and buildings of the Kentucky division of the Illinois Central, with headquarters at Princeton, Ky., has retired. **T. E. Downard,** whose appointment as supervisor of bridges and building, on the Kentucky division, with headquarters at Louisville, Ky., was noted in the July issue, now has jurisdiction over the entire division.

H. R. Morris, whose promotion to master carpenter of the St. Louis division of the Pennsylvania was noted in the October issue, was born on October 7, 1885, at Canton, Ind. After receiving a high school education, he entered the service of the Vandalia (now part of the Pennsylvania) on October 15, 1907, as a carpenter, being promoted to carpenter foreman in January, 1913, wth headquarters at Logansport, Ind. Later in the same year, Mr. Morris was appointed house carpenter foreman in charge of all work at the Logansport terminal. In January, 1924, he was transferred to the Indianapolis division of the Pennsylvania, and in June of this year he was promoted to assistant master carpenter of the Ft. Wayne division, with headquarters at Ft. Wayne, Ind. Mr. Morris retained this position until his recent promotion.

J. E. Rosenbalm, supervisor of bridges and buildings on the International-Great Northern, with headquarters at Palestine, Tex., has been promoted to general inspector of bridges and buildings and water service, with headquarters at Houston, Tex., a newly created position. Mr. Rosenbalm was born on June 12, 1869, at Lone Mountain, Tenn., and after attending college for two years commenced his railway career in 1891. He served as a carpenter and as an assistant foreman in the bridge and building departments of several roads, including the Louisville & Nashville, until February, 1900, when he became engaged with the Macabe & Steen Construction Company, Sapulpa, Indiana Territory (now Oklahoma), as bridge and building foreman on the construction of the line of the St. Louis-San Francisco between Sapulpa

J. E. Rosenbalm

and Denison, Tex. From February, 1901, until July, 1908, Mr. Rosenbalm served as a bridge and building foreman on the Frisco at Springfield, Mo., leaving this road on the latter date to become supervisor of bridges and buildings on the Quanah, Acme & Pacific, at Quanah, Tex. Because of failing health, Mr. Rosenbalm returned to the Frisco in March, 1910, as a bridge and building foreman, being promoted to supervisor of bridges and buildings in July, 1913. He retained this position until December 31, 1922, when he resigned to accept a similar position on the International-Great Northern at San Antonio, Tex., later being transferred to Palestine.

Obituary

Robert Armour, consulting masonry engineer of the Canadian National, died suddenly at Toronto, Ont., on September 10.

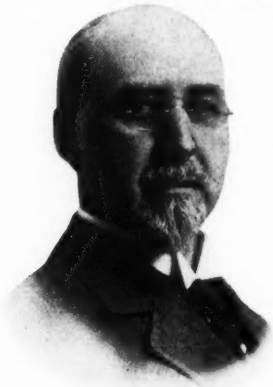
L. D. Blauvelt, formerly chief engineer of the Denver & Salt Lake and since 1921 chief engineer of the Colorado Highway Department, died on October 26 at Denver Colo., at the age of 63 years.

K. P. Williamson, roadmaster on the Union Pacific, with headquarters at Rock Springs, Wyo., died on October 23 from injuries received earlier in the day when his motor car collided with the rear end of a train.

F. M. Case, general foreman of water service on the Northern Iowa and Sioux City divisions of the Chicago & North Western, with headquarters at Sioux City, Iowa, died on October 15, as the result of an automobile accident on October 11.

J. W. Raitt, assistant engineer on the Pocahontas division of the Norfolk & Western, with headquarters at Bluefield, W. Va., died on September 27 following an illness of about two months. Mr. Raitt was born at Shawneetown, Ill., on March 21, 1880, and entered railroad service as a chainman on the Cincinnati, Portsmouth & Virginia railroad in 1898. When this road was taken over by the Norfolk & Western in 1901, Mr. Raitt became a rodman, and was later appointed draftsman in the office of the engineer of branch lines. He resigned in July, 1905, but returned to the Norfolk & Western as a rodman in January, 1907. In March, 1912, he was promoted to assistant engineer of branch lines, and in October, 1914, he was made office engineer for the engineer of branch lines. In October, 1918, he was promoted to chief draftsman in the chief engineer's office, and was made assistant engineer at Norfolk, Va., on January 1, 1924. Mr. Raitt went to Bluefield as assistant engineer in 1926, the position he was holding at the time of his death.

Walter L. Webb, former engineer of track elevation and district engineer of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Chicago, died at his home at Elgin, Ill., on October 13, after an illness of three weeks. Mr. Webb was born at Dover, Mo., 76 years ago and obtained the degree of



Walter L. Webb

civil engineer from Washington and Lee University at the age of 20. For four years after his graduation from college he served under Captain James B. Eads on the South Pass Jetty Works at the mouth of the Mississippi river. He entered railway service in 1879 as a transitman for the Atchison, Topeka & Santa Fe. From 1886 until his retirement in 1926, Mr. Webb served successively on the Milwaukee as assistant engineer, engineer in charge of track elevation at Chicago and Council Bluffs, Iowa, division engineer and district engineer. From 1915 to 1925 he was a member of the damage claim committee of the Chicago Union station.

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From Report of Weed Control and Elimination Committee, Roadmasters' and Maintenance of Way Ass'n, 1929.

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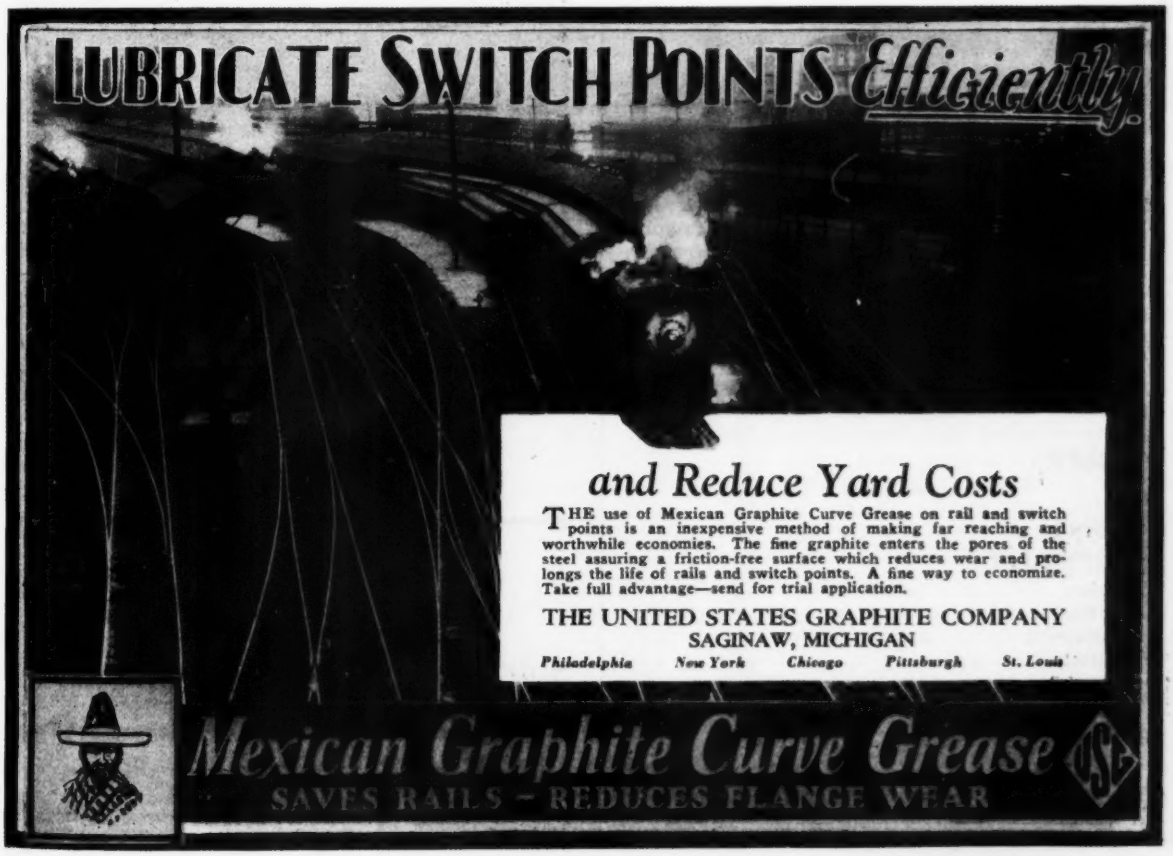

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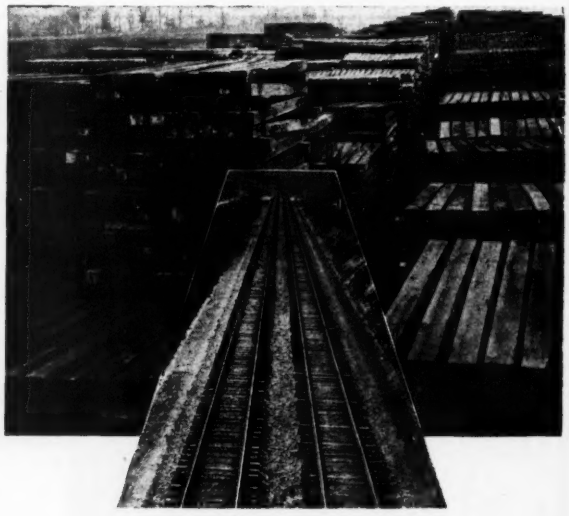

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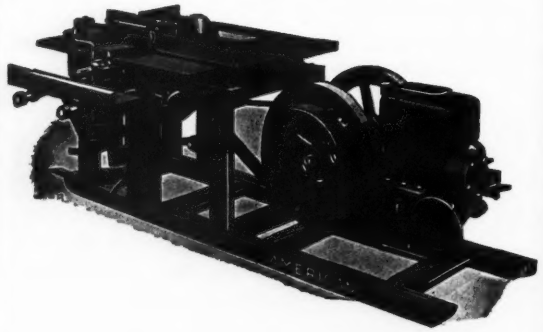

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State of New York } ss.
County of New York}

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Elmer T. Howson, who, having been duly sworn according to law, deposes and says that he is the Editor of the *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 105 W. Adams St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 105 W. Adams St., Chicago, Ill.

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[Seal] (My commission expires March 30, 1931.)

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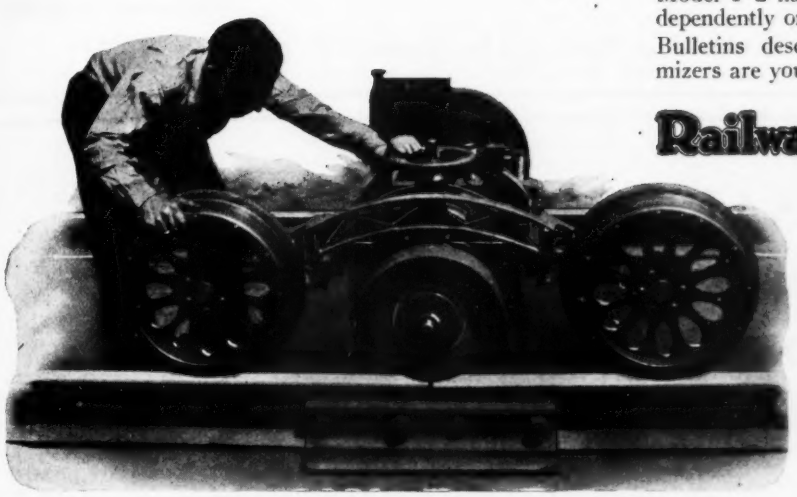

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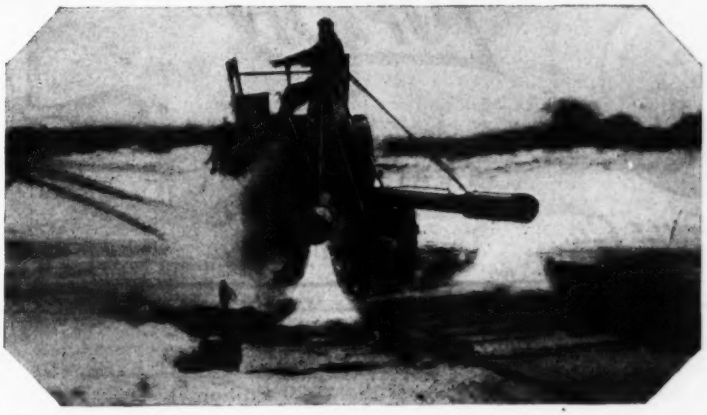

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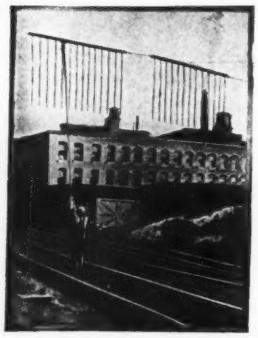

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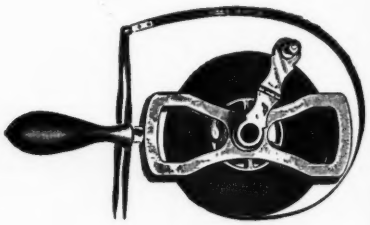

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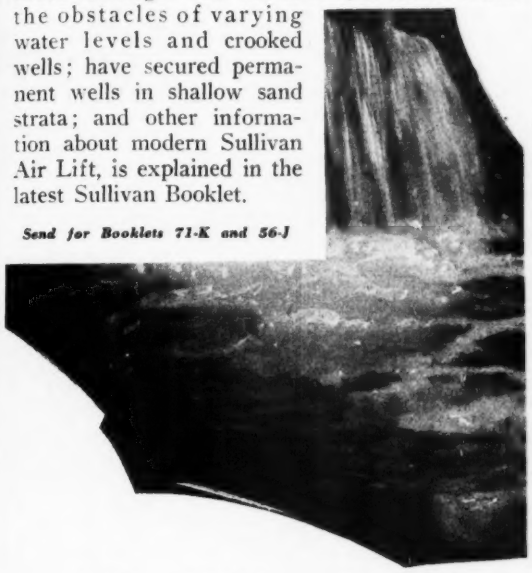

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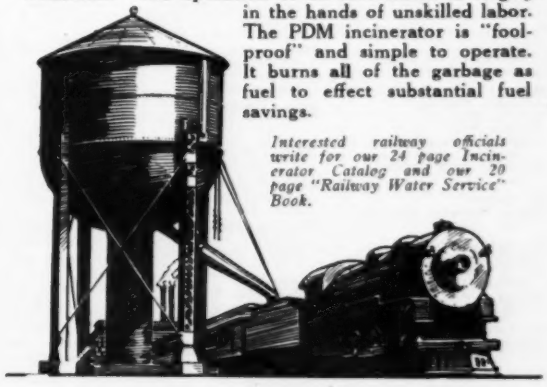

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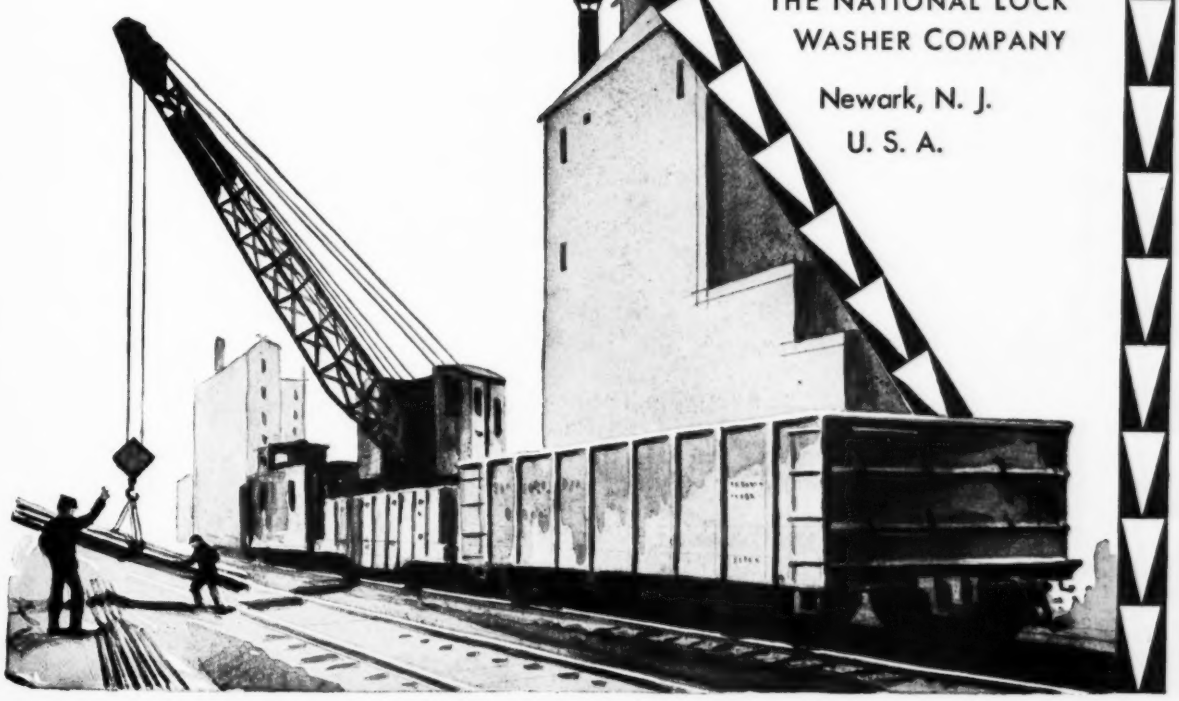

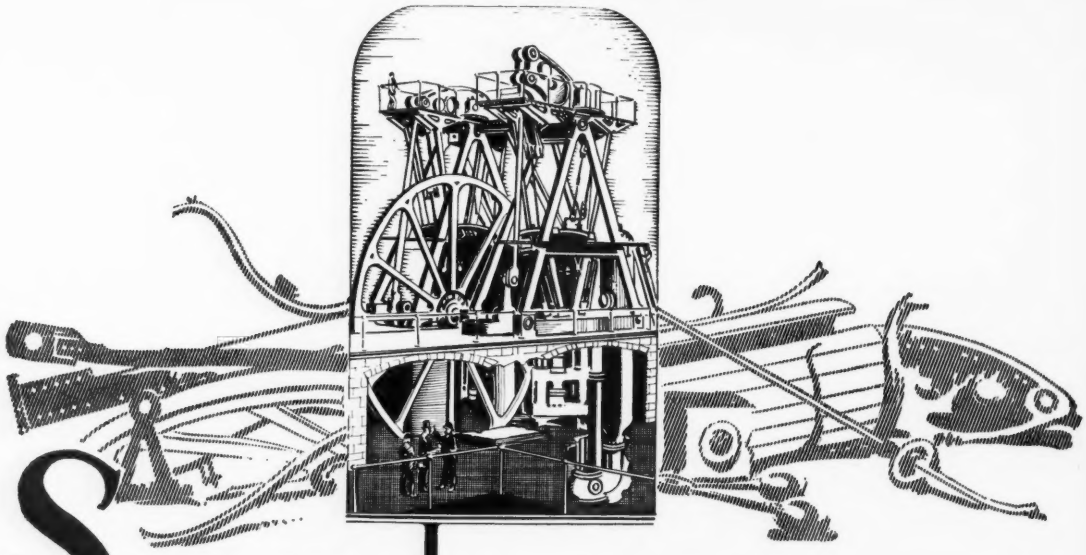

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